RAILROAD GAZETTE

FRIDAY, JUNE 27.

CONTENTS.

Contributions.

Boiler and Steam Chest Pressures.

ALTOONA, June 21, 1890.

TO THE EDITOR OF THE RAILROAD GAZETTE:

In your issue of June 20, under an article on "A Standard Method of Testing Locomotive Engines," we beg to call your attention to a very peculiar statement respecting the difference of pressure between steam-chest and boiler, the writer stating that he has "seen it reach 280 pounds [in steam-chest] when there were 140 pounds in boiler." If the writer has any good grounds for this assertion we should like very much to know what they are.

The only way we can account for such a peculiar fact [?] is that the writer has too suddenly admitted steam to his gauge on steam-chest, when, with some make of gauges, the pressure indicated on gauge would be greatly in excess of the correct boiler pressure; perhaps this error in his gauge has given rise to such misleading statement. G. H. A.

[Mr. Dean assures us that there is no mistake in his statement. The difference in pressure was observed day after day, and this when the steam was admitted to the gauge as gradually as possible. The steam chest pressure reached 280 lbs. but once, but always went above 240 lbs., and returned to the normal pressure slowly, not reaching it until some two minutes after starting. Efforts to correct this were made by connecting the gauge in different ways, but they were unsuccessful. Finally Mr. Dean adopted the practice of not opening the gauge until the engine was well up to speed.—EDITOR RAILROAD GAZETTE.]

A Broken Driving Axle.

CINCINNATI, June 5, 1890.

TO THE EDITOR OF THE RAILROAD GAZETTE:

You may be interested to know the following particulars concerning the breaking of a driving wheel axle which occurred yesterday on the locomotive hauling the westbound limited on the Baltimore & Ohio Southwestern. The train was running about 50 miles an hour on a down grade of about 40 ft. per mile. The axle of the front driver on the right-hand side broke on the line of the outer face of the frame or inner face of the wheel. The engine is American type, four drivers, about 5½ ft. diameter, by the Brooks Locomotive Works. It has no driver brakes.

Both cylinder heads were knocked out, and the piston rod was broken at the connection with the piston. The guide-bar plate was bent and cracked on the lower edge where it joins the engine frame; guide-bars twisted; both eccentrics on right-hand side were broken; the lower corner of the fire box and ash pan stove in, and the wrist pin on the rear driver bent. The engine frame was not damaged at all, but the left-hand parallel rod was bent outward, the middle ordinate being 1⅝ in.

The broken axle showed fine grained steel near the circumference, but in the centre, and about 2 in. in diameter, the fracture showed the coarse grain which you have illustrated in rails squirted through the rolls without sufficient work. On the circumference there was a mark about $\frac{3}{16}$ in. deep as if cut by a tool. This, I think, started the break. The fracture showed no flaw, and the grain was, on the whole, very good. The surface of the break was very near a plane at right angles to the longitudinal axis of the axle. The locomotive stayed on the rails and ran about ⅝ of a mile after the break. No one was hurt and no damage done to the cars. The wheel fell outward, and the back end of the parallel rod twisted off the wrist pin, but the connecting rod was not broken nor badly twisted. It dragged the wheel over the ends of the ties and over a station platform. A PASSENGER.

Railroad Telegraph Superintendents.

The meeting of the Association of Railroad Telegraph Superintendents, briefly reported in our last issue, was continued on the evening of the 18th.

A model track and motor was arranged by Mr. Charles Selden (B. & O.), to demonstrate the increase of traction by the use of the electric current passing through an independent circuit. Two cells of storage battery were used to drive the motor, and two for furnishing the traction current. The demonstrations made after the paper was read showed a large increase in the tractive effort, although there was no provision made for measuring it accurately.

The following is an abstract of Mr. Selden's paper.

After referring to the loss of power from wet rails and other causes and to earlier patents in this field, Mr. Selden described Mr. E. E. Ries' invention. Mr. Ries proceeds upon the hypothesis, that an electric current of large volume, if properly employed, can be used to weld metals. Acting upon this theory he proposes to arrange upon a locomotive a dynamo of sufficient power to be run by a small auxiliary engine and to pass the current from the dynamo to the driving wheel of the engine, along the rail to the next driving wheel, through its axle and the other wheel, to the other rail and back to the first driver, thence to the dynamo, thus making a local circuit, so to speak, which would travel with the locomotive, passing a current through the drivers and along the rail as indicated; and for this purpose he insulates one pair of the driving wheels. By this means the inventor proposes to cause an incipient weld between the driving wheels and the rails. I say incipient because the wheels, being in motion, the weld, if any, is being made and broken by the revolution of the wheels, therefore, a perfect weld is not obtained; nor, of course, would it be desirable except for brake purposes, as in descending a grade for instance. . . . It is not necessary to keep the current flowing all the time, unless you need it, but when you stop the train and want to start it, your locomotive, at that time, not being in motion, a more perfect weld is obtained, thus enabling you to start at once without slipping, and after you have gotten your train under headway, your current, if desired, may be switched off.

Mr. W. W. NICHOLS said that this question had been before the public for considerable time, and there was a great difference of opinion regarding it. He knew nothing of it excepting from his reading. Prof. Blake had made some tests which proved there was nothing in it. There were late reports disproving the results arrived at by Prof. Blake. The mechanical departments of railroads have found it impossible to put sand on the rail, and at the same time keep it exactly where it was needed. In this device the heat apparently causes the oil on the track to evaporate. He could not see why there should be an increase of friction. The heating of surfaces causes a decrease instead of an increase in friction. Prof. Blake's experiments were very pretty and very delicate. They might show different results if repeated on a larger scale.

Mr. SELDEN replied that with all due deference to these experiments, he was prepared to prove that on a grade of 25 % the motor wheels would slip. The very instant the current is passed through the wheels and rails the motor would begin to climb. If this was not the effect of the current, what was it the effect of?

Mr. M. B. LEONARD said it was now generally admitted that the passage of the current produced incipient welding. In Richmond, where the grades of the electric railroad were as high as 12 or 15 %, it had been a question whether the increased adhesion was due to magnetism or incipient welding, but experiments had shown that it was not due to magnetism, and must arise from the passage of the current.

Mr. W. W. NICHOLS, of the Chicago, Burlington & Quincy, then read an interesting paper on Block Signaling, which we must defer printing for lack of space. For the same reason we can in this issue only allude to valuable addresses on the Application of Light at Wrecks, by W. F. Taylor, of the Pennsylvania road; "Electric Applications in Railway Service," by M. B. Leonard, of the Chesapeake & Ohio; on "Train Dispatching," by G. C. Kinsman, of the Wabash, and on "Synchronization of Time," by H. S. Pritchett, Superintendent of Time Service and Watch Inspection of the Wabash.

The association voted to meet at Cincinnati next June. On Friday, after adjournment, the members made an excursion to Toronto by steamer across Lake Ontario, through the courtesy of the New York Central, after which the members dispersed to various points.

EXHIBITS.

The Hall Signal Co. exhibited in operation its automatic electric block and drawbridge signals. Mr. Alvah W. Hall represented the company. The system was described with cuts on page 416 of the *Railroad Gazette*, of June 13. The Edison Phonoplex was shown in practical operation over 185 miles of wire between Niagara Falls and Syracuse. It was carefully shown and explained by Mr. W. S. Logue. Mr. James F. Kelly exhibited four different styles of the Edison-Lalande battery cells. Mr. Thos. Sturgis represented the Electric Service Co., and had in operation this apparatus, which gives a dispatcher full control of a wire, selecting any special office for communication, calling the operator from other duties, etc. Mr. C. A. Scott represented the Union Switch & Signal Co. of Pittsburgh. Mr. M. W. Long, of the Pennsylvania Steel Co., had in operation the magneto-electric semaphore and crossing signals of that company.

Mr. H. B. Thompson, of the Shaver Corporation, erected a 1,000 ft. line having many angles, extending to the post office, over which was operated the molecular telephone, adapted for use in railroad yards. Mr. P. B. Delany showed a collection of his inventions, the electric counter, an improved screw-post, and his improved line adjuster and break repeater, described in the *Railroad Gazette* of Nov. 1, 1889. An invention of A. L. Creelman was shown, which would either close an operator's key or remove a ground wire in 20 seconds by means of a clock train. The O'Neill automatic audible signal for highway crossings was shown by the inventor in practical operation. These bells are in use on the New York, Chicago & St. Louis, and the New York, Pennsylvania & Ohio. An automatic cab signal, for ordinary block signaling and for switch signals, was shown upon a model railroad by the Desant Electric Co., of Columbus, O.

A Convenient Piston Rod Remover.

The small tool shown herewith can be conveniently carried in the tool box of a locomotive for the purpose of removing piston rods in case of a breakdown, or for an examination of the cylinder or piston. It can be used in less than 1¾ in. and the ram has a motion of ⅝ of an in. The force exerted is over 30,000 lbs, and with it a rod can be removed without marring the part with a hammer or drift. The tool is made by Messrs. Watson & Stillman of New York.

Solid Bridge Floors.

Solid iron bridge floors of various constructions have been extensively used in Europe for many years for highway as well as for railroad bridges. In this country they have been used only to a limited extent for some of the better classes of highway bridges. The general construction adopted was buckle plates resting on rolled or built up I beams.

Only in the last few years a few of our best engineers have advocated and used solid iron floors with stone ballast, for railroad bridges. Mr. G. S. Morison, we believe, was the first one in this country to adopt solid iron floors, composed of trough-shaped sections, for some of his bridges. The New York Central & Hudson River is now using this flooring to a large extent, as is also the New York, Providence & Boston.

We present herewith some sketches illustrating the various methods of construction for corrugated flooring made of trough-shaped sections, as manufactured by the Pencoyd Iron Works, at Pencoyd, Pa., for bridge floors, and also for fire-proof floors in buildings. The standard sections are 9 in., 6 in. and 4 in. deep. The 9-in. sections measure about 24 in. between centres of corrugation, and weigh from 25 to 42 lbs. per sq. ft. The 6-in. sections measure about 16 in. between centres of corrugations, and weigh from 25 to 37 lbs. per sq. ft. The 4-in. sections are 12 in. between centres of corrugations, and weigh from 15 to 27 lbs. per sq. ft.

The 9-in. and 6-in. flooring is particularly well adapted for railroad bridges, while the 4-in. flooring is mostly used for highway bridges, and fire-proof flooring for buildings and warehouses.

Fig. 1, represents an elevation, and Fig. 2 a cross-section of a bridge of small span made of this corrugated flooring. This arrangement can be used for spans up to 15 ft. clear. Some of these bridges are in use now on the New York, Providence & Boston, and on the Old Colony. The proper sizes to be used for different lengths of spans are as follows:

Up to 10 ft.	clear	span,	6 ft.	flooring,	35	lbs.	per	sq. ft
10 to 13	"	"	9	"	26	"		"
14	"	"	9	"	29	"		"
15	"	"	9	"	32	"		"

The above table is calculated for the 100-ton consolidation locomotive, and weight of ballast, etc., and about 150 lbs. per sq. ft.; strain on extreme fibre 9,000 lbs. per sq. in.

Fig. 3 is an elevation, and Fig. 4 a cross-section of a plate-girder span, with corrugated iron flooring, the flooring being placed transversely on the upper chord of the longtitudinal girders.

The Seventh street viaduct, Omaha, which carries the tracks of the Union Pacific Railway over Seventh street, designed by Mr. Geo. S. Morison, is a good example of plate-girder bridge with solid flooring; also, one of the spans of the crossing of the Baltimore & Ohio over the

Schuylkill River at West Falls, Philadelphia. There are also a number of plate-girder bridges with similar flooring on the New York Central & Hudson River.

Fig. 5 is an elevation, showing the flooring resting on the top chord of a deck lattice bridge at Saundersville, Mass., on the New York, Providence & Boston. This illustrates more particularly the detail at the end over bridge seat. The same arrangement will also answer for pin-connected, through spans, where the flooring will be carried on the top of the iron floor stringers; or for plate girder through spans, the floor resting on and being riveted to the bottom flange or to an angle provided for that purpose.

The following table gives the depths of flooring and weights per square foot for different distances between centres of girders supporting flooring, the corrugations being placed transversely, as shown in figs. 3 and 4:

Distance between girders.			
6 to 9 ft.	6-in. flooring,	24.5 lbs.	per sq. ft.
10 to 11 "	9 " "	25.5 "	" "
12 "	9 " "	27.5 "	" "
13 "	9 " "	30.0 "	" "
14 "	9 " "	32.5 "	" "
15 "	9 " "	34.5 "	" "
16 "	9 " "	37.5 "	" "

The above table is calculated for the 100-ton consolidation locomotive and ballast weighing about 150 lbs. per sq. ft; fibre strain on flooring 9,000 lbs. per sq. in.

The principal objection which has been made by many engineers, of the conservative kind, against the use of solid iron floors is the following: As only the under side is accessible to inspection, cleaning and painting, the upper side being covered with ballast and not accessible, corrosion can take place without being detected. As the ballast covering will somewhat retain the moisture, or prevent it from evaporating this, it is thought, would be a serious matter. This objection is, however, not well founded; as by a proper treatment the metal may be effectively protected against corrosion. The upper side can also be easily inspected from time to time, by removing portions of the ballast so that the condition of the metal can be examined, the same as any other part of a metal structure.

Various methods are employed for protecting the iron flooring against corrosion. The specifications used by the New York Central & Hudson Railroad, are as follows:

1. The plates and angles of the floors shall be immersed in a bath composed of the following ingredients:

Warren's Anchor Brand Asphalt	70 parts.
Coal Tar Pitch	30 "
Total	100 "

The bath shall be heated to 350 degs. F.; the plates and angles immersed shall show a temperature of 300 degs. F., at an interval of five (5) minutes after removal from bath.

2. All field rivet heads shall be well coated while warm.

3. The bottom troughs shall be covered with "binders" curving to centre of troughs, and to drain to centre gutter.

The "binders" shall be composed of clean gravel 1½ in. to ¾ in. diameter, heated 300 degs. F., and mixed with No. 4 paving composition, one (1) to one (1) cu. ft. of gravel.

The New York Providence & Boston uses the following method:

The flooring is coated with a mixture composed of seven parts of asphalt and one part of thick black oil, heated till liquid enough for painting. The corrugations are filled to 2 in. above the top with tar and fine gravel (see fig. 6), then comes a layer of asphalt concrete, 2 in. thick, upon which the stone ballast is placed.

Fig. 7 represents a cross-section and fig. 8 a longitudinal section of the flooring used on a highway bridge at Lonsdale, R. I., built by the New York, Providence & Boston.

Figs. 9, 10 and 11 represent several arrangements for using corrugated shapes for fire-proof floors of buildings.

Figs. 12 and 13 show the construction of flooring used in the new office building of the Pencoyd Bridge & Construction Co., at Pencoyd, Pa.

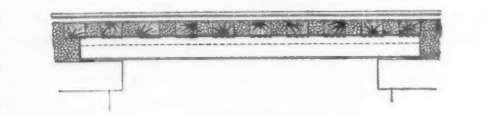
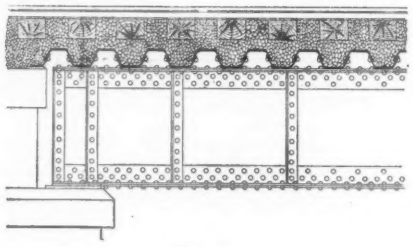


Fig. 1.


Fig. 2.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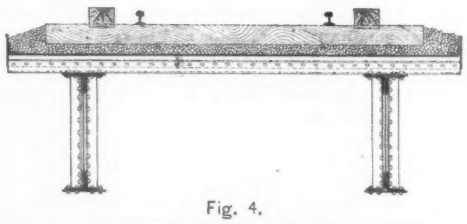
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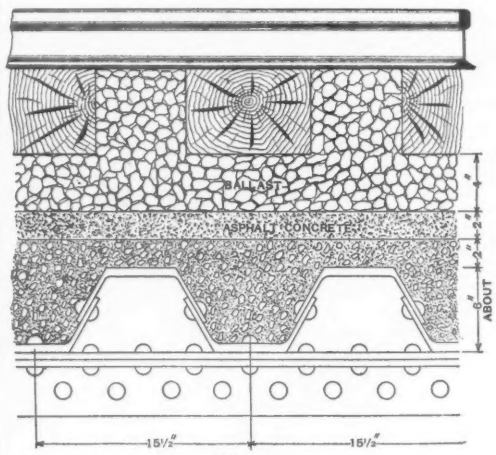


Fig. 6.

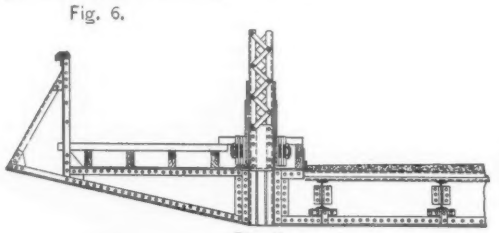
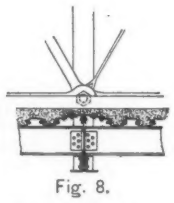


Fig. 7.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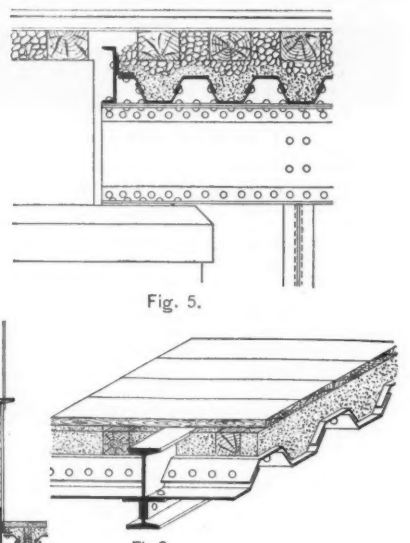


Fig. 5.

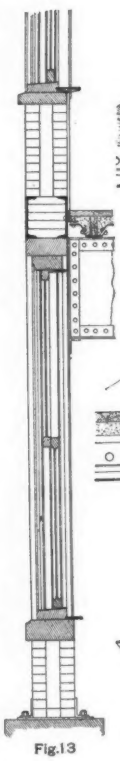


Fig. 13.

Fig. 9.

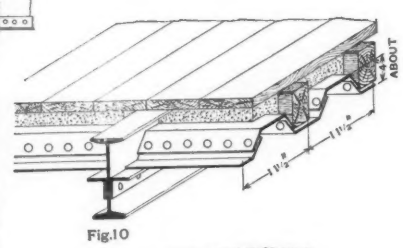


Fig. 10.

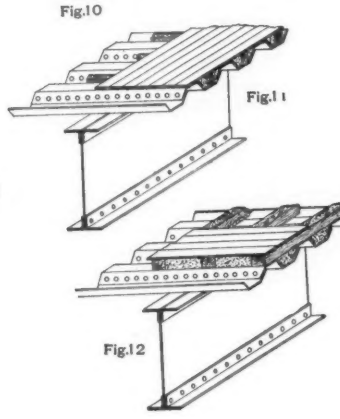


Fig. 11.

Fig. 12.

SOLID CORRUGATED FLOORS FOR BRIDGES AND BUILDINGS.

As made by the PENCOYD BRIDGE & CONSTRUCTION CO., *Pencoyd, Pa.*

Wooden Trestle Bridges.*

BY WOLCOTT C. FOSTER.

HIGH TRESTLES ON THE ST. PAUL, MINNEAPOLIS & MANITOBA RAILWAY—CONCLUDED.

The illustrations accompanying the article in the present issue show a second style of construction for high trestles adopted on the St. Paul, Minneapolis & Manitoba. It will be noticed that there is a considerable difference between this plan and that published in the *Railroad Gazette* of June 13.

The addition of a guard rail to the floor system is a considerable advance. While it is hardly high enough to be of much use in preventing a derailed train from leaving the trestle, still it is deeply notched, and will go a very long way toward preventing the ties bunching in case of an accident. The ties are of oak, spaced 12 in. between the centres, leaving a space of but 4 in. between the ties. The ends of the ties are supported by jack stringers, and were the guard rails but a little higher this would be almost a perfect floor. It is, in fact, about perfect when compared with 90 per cent. of the floors in use.

The guard rails are fastened to the ties by ⅝ in. × 12½ in. bolts. Neither the head nor nut of the bolt are countersunk into the woodwork. A washer is placed under both head and nut. The ties are spiked to the stringers by ½ in. × 10 in. spikes, and the stringers in their turn are driftbolted to the floor beams by ¾ in. × 20 in. drift bolts. The design of the track-stringer joints is not such as to afford the greatest strength, but this is hardly necessary considering the manner in which the stringers are supported. The floor beams are arranged in about the same manner as in the design previously described. They are driftbolted to the substringers or girders by ¾ in. × 20 in. drift bolts. The girders, of which there are three to each bay, are, in their turn, driftbolted to the caps. These girders rest upon the top chords of trusses, and are thus very greatly strengthened. The truss rods, which are 1¼ in. in diameter, extend from the bottom chords up through the girders. The top chord and end posts of the trusses are of 10 in. × 10 in. timber, while the bottom chord is of 10 in. × 12 in. timber. The panel diagonals are 5 × 8 in., and rest upon oak foot blocks. Three trusses are placed over each bay, one under each girder. They are held in place by being bolted to the caps of the second story of each bent and by tie rods and lateral bracing. The lateral bracing is made of 6 in. × 7 in. material. The ends of the trusses rest upon corbels, supported by the second story caps. The corbels are notched 2 in. over the caps.

The first or upper story of each bent is practically independent of all the other stories. It is framed together, the posts being joined to both cap and sill by mortise and tenon joints, and is the only story in which the two inner posts are vertical. The outer posts have the same batter as the outer posts of the other stories, *i. e.*, 2 in. to 1 ft.

The sill of the upper story forms the cap of the one below it. The lower posts are connected with this cap by mortise and tenon joints. Throughout the entire structure the caps, posts and sills are compound, being made up of two 10 in. × 12 in. timbers bolted side by side, but separated 6 in. by wooden packing blocks. These blocks also act as splice blocks. Below the upper story the posts are continuous through the different stories, being formed of timbers placed end to end with bolted joints. No two joints are allowed to come over the same splice block. Below the top story none of the posts are vertical, neither are any counter posts introduced.

The posts are joined to the sill by mortise and tenon joints. The sill rests upon subsills or pile caps of 12 in. × 14 in. white oak, into which it is notched 1½ in. as well as being driftbolted down by ¾ in. × 20 in. drift bolts. The caps are also fastened to the piles by drift bolts of the same size. There are two piles driven beneath the foot of each post and spaced 3 ft. from centre to centre.

The sway bracing, as in the previous design, is all inclined in one direction. The horizontal sway bracing is notched over the posts 1¼ in. The longitudinal bracing

is also notched over the posts. The entire structure is stiffened by bracket braces spiked to the posts and the longitudinal braces.

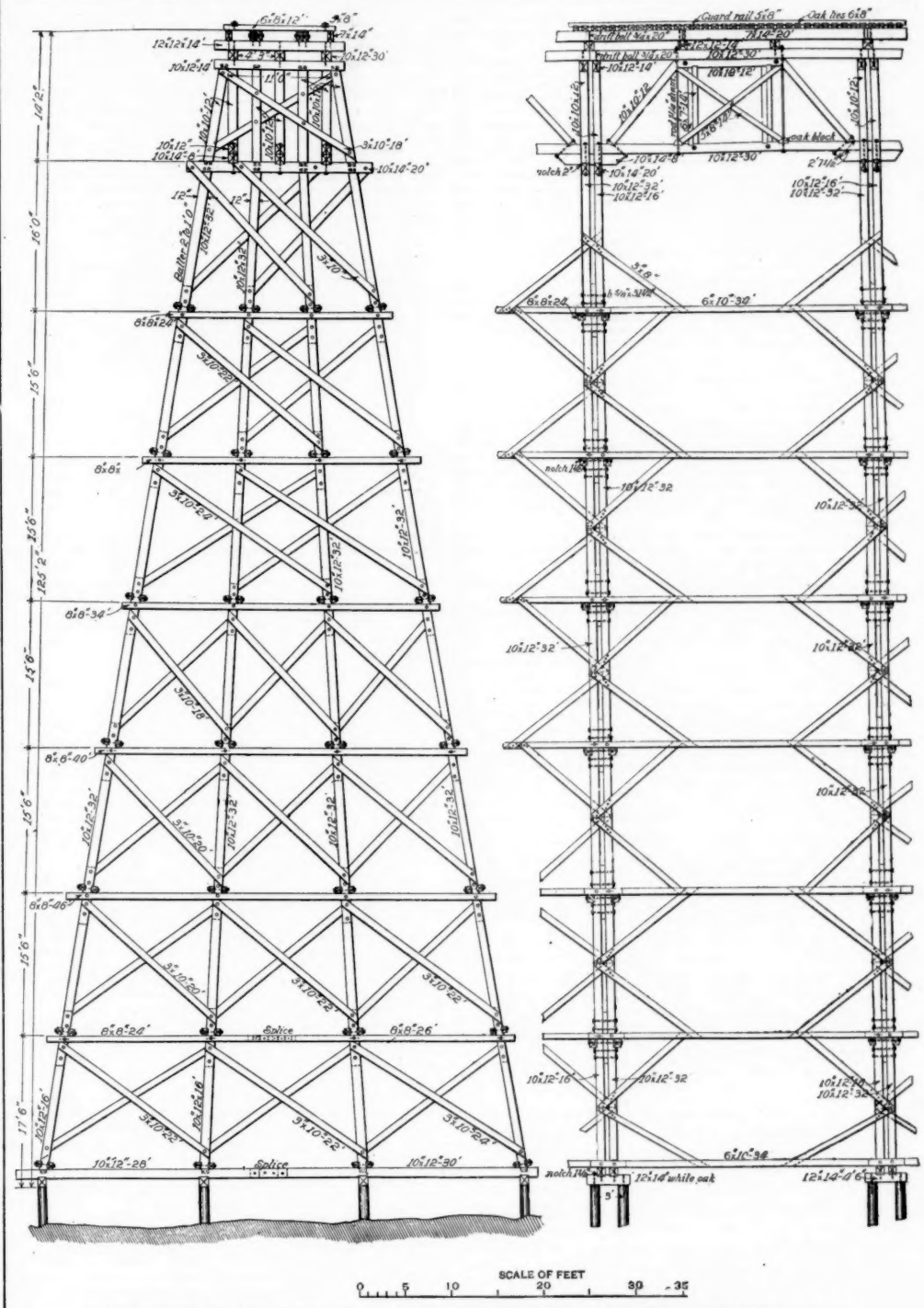
Following is given a list of the dimensions of both the timber and iron work for the trestle illustrated in this ssue:

BILL OF TIMBER.

Name.	Size.
Floor system:	
Guard rails	5 in. × 8 in.
Ties	6 in. × 8 in. × 12 ft.
Track stringers	7 in. × 14 in. × 20 ft.
Jack stringers	7 in. × 14 in. × 20 ft.
Floor beams	12 in. × 12 in. × 14 ft.
Sub-stringers or girders	10 in. × 12 in. × 30 ft.
Supporting trusses:	
Bottom chords	10 in. × 12 in. × 30 ft.
Top chords	10 in. × 10 in. × 12 ft.
End post or diagonals	10 in. × 10 in. × 12 ft.
Panel diagonals	5 in. × 8 in. × 14 ft.
Lateral bracings	6 in. × 7 in. × 14 ft
Foot blocks, oak:	
Corbels (supporting ends of trusses)	10 in. × 14 in. × 8 ft.
First or top story:	
Cap	10 in. × 12 in. × 14 ft.
Vertical posts	10 in. × 10 in. × 12 ft.
Batter posts	10 in. × 10 in. × 12 ft.
Sway bracing	3 in. × 10 in. × 18 ft.
Second story:	
Cap	10 in. × 14 in. × 20 ft.
All posts	10 in. × 12 in. × 16 ft. 10 in. × 12 in. × 32 ft
Sway bracing (diagonal)	3 in. × 10 in. × 20 ft.
Sway bracing (horizontal)	8 in. × 8 in. × 24 ft.
Third story:	
Posts as in second story.	
Sway bracing (diagonal)	3 in. × 10 in. × 22 ft.
Sway bracing (horizontal)	8 in. × 8 in. × 30 ft.
Fourth story:	
Posts as in second story.	
Sway bracing (diagonal)	3 in. × 10 in. × 24 ft.
Sway bracing (horizontal)	8 in. × 8 in. × 34 ft.
Fifth story:	
Posts as in second story.	
Sway bracing (diagonal)	3 in. × 10 in. × 18 ft.
Sway bracing (horizontel)	8 in. × 8 in. × 40 ft.
Sixth story:	
Posts as in second story.	
Sway bracing (diagonal)	3 in. × 10 in. × 20 ft.
Sway bracing (horizontal)	8 in. × 8 in. × 46 ft.
Seventh story:	
Posts as in second story	3 in. × 10 in. × 20 ft.
Sway bracing (diagonal)	3 in. × 10 in. × 22 ft.
Sway bracing (horizontal)	8 in. × 8 in. × 24 ft. 8 in. × 8 in. × 26 ft.
Horizontal sway bracing splice block	6 in. × 8 in. × 5 ft.
Eighth story posts as in second story	3 in. × 10 in. × 22 ft.
Sway bracing (diagonal)	3 in. × 10 in. × 24 ft.
Sill	10 in. × 12 in. × 28 ft. 10 in. × 12 in. × 30 ft.
Sub-sill or pile cap (white oak)	12 in. × 14 in. × 4 ft. 6 in.
Sill splice block	6 in. × 12 in. × 4 ft.
Miscellaneous:	
Longitudinal bracing	6 in. × 10 in. × 34 ft.
Bracket braces	3 in. × 8 in.
Post splice blocks	6 in. × 12 in. × 6 ft.
Foundation:	
Piles	8 to each bent.

BILL OF IRON.

Name.	Size.	Use.
Bolts	⅝ in. × 12½ in.	Guard rails to ties.
	⅞ in. × 17½ in.	Stringer pieces together, *i. e.*, packing bolts.
	⅝ in. × 27½ in.	Longitudinal braces to posts.
	⅝ in. × 28½ in.	Post joints.
	⅝ in. × 31½ in.	Diagonal sway bracing through posts.
	⅝ in. × 41½ in.	Horizontal sway bracing through posts.
Drift bolts	¾ in. × 20 in.	Stringers to floor beams, floor beams to sub-stringers, sub-stringers to caps, main sill to pile caps, pile caps to piles.
Spikes	⅛ in. × 10 in.	Ties to stringers.
	⅜ in. × 7 in.	Sway bracing to posts, bracket braces to posts and longitudinal bracing.
Iron in Trusses:		
Rods	1¼ in. × 11 ft 4 in.	Between top and bottom chords.
Tie rods	— × —	Three trusses together.
Bolts	— × —	Intersection of panel diagonals.
Bolts	— × 2 ft. 11 in.	End posts to bottom chords.
	— × 3 ft. 5½ in.	Bottom chords and corbels to caps.



HIGH TRESTLES ON THE ST. PAUL, MINNEAPOLIS & MANITOBA RAILWAY. Fig. 2.

The Master Mechanics' Association.

At the second day's meeting the first business was the report of the Committee on Compound Locomotives, which was in substance as follows:

1. *Is compounding of any value without increase of boiler pressure?* This query is due to the repeated assertion that in compounding there was not, and could not be, an economy in steam consumption, unless the boiler pressure be decidedly increased, raised to 170 lbs., or even higher. The results of the experiments of Mr. T. Urquhart, Locomotive Superintendent G. & T. Railway (Southeast Russia), contradict this statement. The trials cover a period of 10 months, in the same class of service, with simple and compound engines practically of the same weight, and all with pressures of 135 lbs., and they show for the compounds a general average saving in fuel of 18 per cent.

Apart from this solution of the vexed question of pressure, Mr. Urquhart's experience is unusually interesting, because the experiments were carried out in cold weather, with oil fuel, which has a more uniform heating quality than soft coal; and the delivery of the fuel into the fire box was almost automatic, thus practically getting rid of the "personal factor," for which it is always necessary to allow in comparing special and brief experiments.

Mr. C. Sandiford, of the N. W. Railway, Lahore, India, reports a 13½ per cent. economy with unaltered but still lower pressures, viz., 120 lbs., the saving being the same whether the steam was used in two or four cylinder (tandem) engines.

These results will not surprise those who are familiar with exactly parallel cases in other forms of steam engineering.

Do not misunderstand us to say that there are no economies in higher pressures. There are wide possibilities with high temperature; and the many published figures, from recent trials, stoutly confirm our opinion. But under this leading heading, the committee wished to emphasize the fact that compounding, at ordinary working pressures, has its own value as an economizer of steam, without keeping hid the sister fact that higher pressures give an additional possibility. And it should not be forgotten that very high pressure steam has, so far, only been fully utilized by passage through more than one cylinder.

Higher pressures and very early valve cut-offs, for simple engines, have had a fair trial on many of our railroads; nevertheless, to-day initial cylinder pressures above 150 lbs. are rare, and we believe that when boiler pressures higher than 160 lbs. are retained, it is with the object of making the boiler a reservoir of power for starting and grade climbing, rather than with a confirmed faith that very early cut-offs lower the fuel bill.

The Saxony Railroad report increasing their boiler pressures for simple engines from 8½ to 12 atmospheres (say from 120 to 175 lbs.), without resultant economy; whereas 212 lbs. has not proved too high for convenience or economy in the compound practice of the P. L. & M. Railroad (France).

2. *What gains have followed compounding?* (*a*) It has achieved a saving in the fuel burned averaging 18 per cent. at reasonable boiler pressures, with encouraging possibilities of further improvement in pressure and in fuel and water economy. (*b*) It has lessened the amount of water (dead weight) to be hauled, so that (*c*) the tender and its load are materially reduced in weight. (*d*) It has increased the possibilities of speed far beyond 60 miles per hour, without unduly straining the motion, frames, axles, or axle boxes of the engine. (*e*) It has increased the haulage power at full speed, or, in other words, has increased the continuous horse power developed, per given weight of engine and boiler. (*f*) In some classes has increased the starting power. (*g*) It has materially lessened the slide valve friction per horse power developed. (*h*) It has equalized or distributed the turning force on the crank pin, over a longer portion of its path, which of course tends to lengthen the repair life of the engine. (*i*) In the two-cylinder type it has decreased the oil consumption, and has even done so in the Woolfe four-cylinder engine. (*j*) Its smoother and steadier draught on the fire is favorable to the combustion of all kinds of soft coal; and the sparks thrown being smaller and less in number, it lessens the risk to property from destruction by fire. (*k*) These advantages and economies are gained without having to *improve* the man handling the engine, less being left to his discretion (or careless indifference) than in the simple engine. (*l*) Valve motion, of every locomotive type, can be used in its best working and most effective position. (*m*) A wider elasticity in locomotive design is permitted; as, if desired, side rods can be dispensed with, or articulated engines of 100 tons weight, with independent trucks, used for sharp curves on mountain service, as suggested by Mallet and Brunner. One such engine of 80 long tons is now under construction.

3. *What losses are said to have followed compounding?* (*a*) In some particular types, as actually proportioned, a loss in starting power of from 15 to 20 per cent. However, loss of power in starting cannot be said to be a defect in the principle of compounding. (*b*) An increase in the number of parts. They are few and plain in the two-cylinder engine, entailing little outlay in first cost or in repair. (*c*) A possible, but, this committee thinks, not probably increase in the cost of repairs to the boiler, per pound of fuel burnt, if higher pressures are used. Positive information on this point is difficult to obtain. (*d*) An increased cost of repairs to the engine per mile run. This item is not yet large enough to be measurable, after three years' continuous service in the plainer forms of the two-cylinder compounds. (*e*) A larger percentage of failures on the road due to a greater complication and size of parts. (*f*) Increased reciprocating weights on one side, either not balanced, and so increasing the deflection of the engine, or, if approximately balanced, the balance weight doing injury to the roadbed, etc. The two last sections seem to be pure suppositions, which, after search, we find no evidence to sustain. (*g*) Want of variability or adaptability to wide extremes in speed, and to amount of work to be performed; so that a large compound does not work as cheaply when hauling light loads, or running without load, as a simple engine does.

It is not proved that a compound, working properly throttled, that is, with steam wire-drawn, may not have actually, as she theoretically has, a wide and economical adaptability. So that if the compound, like any other motor, be not as economical when exerting low power as when exerting full power, it probably will use less steam than the simple engine of same weight, working under similar conditions of light haulage duty.

However, the one thing certain about "American conditions" is that no large portion of our motive power does run lightly loaded, and until we have a wider experimental experience, it is not recommended that all locomotives, doing branch and local light service, be built compound.

4. *What is the increased first cost per engine?* M. V. Borries has published figures giving cost. In speaking of his own design of engine, he says they can "be built 2 to 5 per cent. cheaper than single engines of the same power—not of the same maximum tractive force; because this power depends upon the boiler, which might be 10 to 15 per cent. smaller for the compound engine. If the same boiler is kept, as is commonly the case, the compound engine would be some 2 or 3 per cent. heavier, and 4 or 5 per cent. more costly than a simple one; but, with properly dimensioned cylinders, 10 to 15 per cent. more powerful than the latter. For equal work the compound engine would always be the cheaper engine." Mr. E. Worthington says: "The intercepting valve and copper pipes forming the receiver, and the patterns for two different sizes of cylinders, are the chief items which raise the cost of a two-cylindered compound locomotive; while engines with three or more cylinders have additional parts, which considerably increase their cost. In engines with four cylinders, the tandem system is cheaper than the receiver system. Tandem cylinders are, however, objectionable, because the pistons are difficult to examine; but the receiver system is ready of access, and affords an opportunity of heating the intermediate steam by circulating it among the waste gases of the smoke box; and, by isolating the high-pressure and low-pressure cylinders, an advantageous difference of temperature is maintained between them.

"The cost of constructing a number of two-cylindered locomotives does not greatly exceed that of the same number of ordinary engines. The cost of three-cylinder locomotives may exceed that of simple engines by $1,000 to $1,250 each."

The cost of changing simple to two-cylinder engines need not exceed $250 to $300 each, if the expense of drawings, patterns, and templets be divided over a series of engines. The additional cost of building a two-cylinder engine, with receiver, etc., as used by the Michigan Central Railway, or the

ingenious form of four-cylinder engine, as used by the Baltimore & Ohio Railway, need be little, if anything, over $200 (excluding royalties), or say from 2 to 2¼ per cent. increase on the cost of a simple engine.

5. *Does the saving more than balance the increased first cost?* If, for convenience, the fuel saving be taken at 17 per cent., or 1-6, and the gross consumption at 900 tons per year, with coal at $1.50 per ton, the decrease in the annual fuel bill is but $225. Certainly not a wide margin to cover contingencies. If, however, at first only the more powerful engines are compounded, whose consumption averages 1,200 tons per year, and coal, as is common, costs on tender $3 per ton, the saving on fuel is $600, or two cents per mile on a mileage of 30,000 per annum. As this amount would cover not only reasonable interest on first cost, but also allow for about 33 per cent. increase in total expenditure for motive power, repairs and renewals, the saving is certainly enough to permit a possible, but, we think, not a probable, largely increased cost of engine repairs, and yet have a margin of saving on the final balance sheet to the credit of the compound.

6. *What are "American conditions" for locomotive service?* Can the compound engine meet them? We have given this section a large amount of attention, because it has so often been said that the compound must, to be successful on this continent, be adapted to suit American conditions, and your committee were naturally desirous of fully understanding these conditions. They have not been specified by those making the assertion; and we must reluctantly confess to having failed to identify, much less define them, so that after a long, unsatisfactory chase, they appear to us to be somewhat mythical. If any member can, and will, specify them, he will confer a favor, at least upon the committee, if not upon the Association.

If an American condition be large starting power, then the Mallet two-cylinder and all four-cylinder engines easily have cylinder power in excess of their adhesive weight. If American conditions be ability to do satisfactory work on a second-rate or third-rate roadbed, or simplicity of construction, or easy accessibility of parts, then these conditions are met by any two-cylinder engine, or by the Baltimore & Ohio Railway four-cylinder engine.

Apparently neither climate nor men are factors in this equation, as compounds are a success in the hands of ordinary enginemen in partially civilized countries; and in hot climates, as well as in Russia, under conditions of low temperature and snow as trying as those ordinarily met with inside of 51 degrees, the present northern limit of our railway belt.

7. *Is it an essential defect of compound locomotives that they must be short of starting power?* Certainly not! The starting power of the Mallet type is at least equal to that of a simple engine of the same weight, and its cylinder power can easily be made to exceed it, by allowing more than half boiler pressure in the large cylinder for the first few revolutions. In the V. Borries, Worsdell, Pitkin and other two cylinder types, and the Lepage three-cylinder engine, their starting power (as Professor Woods has graphically illustrated), at 170 lbs., may be greater than that of a simple engine at 150 lbs., having cylinders of the same size as the high pressure, *during the first half revolution*, but that after this the power (at low speed) of the compound diminishes to 80 or 85 per cent. of that of the simple engine. This conclusion is modified and improved by the knowledge that all two-cylinder engines originally designed as compounds have, or should have, their small cylinder larger than the cylinder of the simple engine of corresponding weight or duty.

It is possible, with the Lindner or equivalent form of starting valve--and a painstaking engineman--to get about 90 per cent. of the starting power of a corresponding simple engine. The Webb type of three-cylinder engine (except with the low-pressure crank dead on centre) has cylinder power enough to slip both pairs of wheels, and no higher starting power is desirable. What may be called the opposite form of three-cylinder engine (the Sauvage type), with cylinders of approximately the same diameter, as used on the Northern Railway of France, has ample starting power, because the full boiler pressure is admitted direct to the two low-pressure cylinders. In fact, if desired, the locomotive can be continuously so worked, *viz.*, as a simple engine. Tandem and other forms of four-cylinder engines are not wanting in starting power. The B. & O. Ry. engine in starting, with a gear as simple as the water-tap gear, puts the small piston practically into equilibrium, and thus admits high-pressure steam to the large cylinder.

A mean effective pressure of 90 lbs., in a simple 18x24 in. engine, will start a train of 13 coaches on a level in a lively fashion, and a compound can easily give the equivalent of that total pressure without being over-cylindered.

Going back to the two-cylinder style of engine, with automatic intercepting valve, and limited size of cylinder, it would seem as if all of them were capable of getting into motion the load they were designed to haul at full speed, so that their limitations are that they do not get away quite as smartly, quite as nosily, or with the same tearing effort on fire and fire box, as do certain simple engines that waste both fuel and steam in starting. The comparative difference, in time or distance, required by this class of compound to attain maximum speed has not yet been shown by experiment, but is probably less than is generally supposed.

Mr. Urquhart, desiring to settle the question of the tractive power of simple engines altered to compound, with one cylinder unchanged, and with boiler pressure unchanged, carried out tests, using both indicator and dynamometer; and he reports that at a speed of 10 miles per hour the compound passenger engine suffered the following diminution, viz.; in first notch, 42 per cent.; in second notch, 28 per cent.; in third notch, 17 per cent.; in fourth notch, 7 per cent.; and in fifth notch, or full gear, 5 per cent. And a similar test of the freight compound showed,in the first notch, 27 per cent. loss; in the second notch, 17 per cent.; in the third notch, 10 per cent.; and in the fourth notch, or full gear, 5 per cent. He goes on to say that, for all practical purposes, in full gear a 5 per cent. difference, at this speed, may be neglected.

8. *General.*—A recent press notice credits Mr. Webb with an attempt to reduce first cost by throwing away the valve gear for the low-pressure cylinder, and using in its place a single loose reversing eccentric; in other words, with an attempt to use an invariable cut-off for the large cylinder. And such practice is not unreasonable, if it from the first be acknowledged that the compound is designed for doing a maximum specific duty with high economy, and, therefore, the valve gear cannot be, and is not, arranged for a wide variability of service.

This intention in design most clearly marks all those engines using but one valve, or one valve stem, to distribute the steam to both high and low pressure cylinders; such, for instance, as the Vauclain piston valve, the Woolfe hollow D valve, and the Dunbar single valve stem. In the two first mentioned most ingenious valves, the release of the high-pressure cylinder must be at the same moment as the admission to the low-pressure, or it is no actual release; and the cut-off in the low-pressure cylinder marks the exact point when compression in the high-pressure cylinder commences, there being no appreciable "receiver" capacity in the valves themselves, large as the passages through them have to be. There is, then, it is clear, little elasticity of adjustment in such valves and gears. The cut-off being early in the small cylinder, it must be early in the large, and as a result the compression in the small cylinder is enormous. Thus the conclusion is again brought home to us that the control of the compound, when small horse power is to be developed, must be chiefly through the throttle wiredrawing the steam, and thus reducing the initial pressure.

Putting emphasis on this truth will not frighten those who are familiar with the fact that wire-drawing is common to-day with our best enginemen. And it may here be noted that the *imperative necessity* for this so-called "crude practice" is the full explanation for the slight use in modern locomotives of screw and other finely divided reversing gears. This statement opens up the whole matter of cylinder condensation, but it is too large a matter to be properly treated in this report.

However, such modern experimenters as Westinghouse, Kennedy, etc., prove that wire-drawing the admission into cylinders of large surface and small volume is more economical than valve cut-offs at less than 50 per cent of the stroke.

There are some constructive details and peculiarities about compounds that may deserve special mention. For instance, it is judicious to put safety or relief valves on the low-pressure chest or cylinder, but they should be so located or guarded that in case they came into action, they would not smother the engineman with steam, and obscure his vision. All types do not require water-taps on both cylinders, but most receivers should be so drained. If an intercepting valve is used, a reducing valve is not required, and if an intercepting valve is not used, there must be a valve to give independent exhaust direct to the atmosphere from the high-pressure cylinder. The weight of evidence, so far, is in favor of the use of an intermediate receiver. Such a device effectually isolates the cylinders, so that each retains its distinctive temperature. The general practice of drying the intermediate steam by putting the receiver in the smoke box, has much to recommend it. Copper pipes, set close to the curve of the smoke box, are not cumbersome or much in the way; and if it be desired that the feed-water, also, be heated in the smoke box, the large receiver pipes need not interfere with the details of such an arrangement. Receiver capacity cannot, under our limiting conditions, be too large. It should never be less than 1½ times the volume of the high-pressure cylinder, and two or more volumes are desirable; because, with a liberal receiver the steam supply to the low-pressure cylinder is more uniform in pressure and amount, the reheating or drying of the steam is more thoroughly done, and "the drop" in pressure between high-pressure final and low-pressure initial is less detrimental to steam economy.

If one side of a compound should break down the other side can be run as a single cylinder engine, if the failure is not due to a total collapse of the cylinder on the side to be blocked. And in a tandem, as in a simple engine, the failure on one side may be a total collapse, without its interfering with the use of the other side as a single engine.

J. DAVIS BARNETT,
JOHN PLAYER,
H. D. GARRETT,
F. W. DEAN.

Mr. BARNETT: "It has been customary to issue circulars of inquiry, but in this case so few are using this class of locomotives that we did not deem it best. Regarding the economy of using steam at low pressures for compounding much can be said in its favor. It is well-known that in stationary and marine engine practice it has been found practicable to use compound engines even at pressures as low as 80 lbs. per sq. in. Compounding is more successful in cases where the amount of power does not fluctuate. Mr. Drummond, of the Caledonian Railway, Scotland, is using high pressures even above 200 lbs. per sq. in. without compounding. High pressure with an early cut-off in large, simple cylinders, is not desirable."

The Secretary read a letter from Mr. Leeds, Superintendent of Motive Power of the Louisville & Nashville. This letter discussed at considerable length the advantages and disadvantages of compounding, and arrived at the conclusion that it would not be advisable for the Louisville & Nashville to adopt the compound locomotive for general use or for the purpose of experiment until it had been further developed by those using it. He said that Mr. Angus Sinclair, before he went to Europe, was a strong advocate of compounding, but quotes him as saying after his return, "It is an open question. A month spent in the home of the compound locomotive took away a great deal of the faith previously held in that type of engine."

Mr. Sinclair stated before the Association that he had found that he had made many mistakes regarding compounds, and was beginning to find them out.

Prof. ARTHUR T. WOODS, of the University of Illinois, who had just been proposed for associate membership, then spoke as follows: "When I started to investigate I was in doubt as to the value of compounding locomotives, but as I delved deeper into the subject the difficulty disappeared. I have thus far found only one record of failure; that was on the Boston & Albany, in an engine with cylinders arranged tandem. Most of the arguments of the opponents of this system are the same as those which were cited against compound engines for marine work in the early days. But now, even in small torpedo boats, they have not only found the compound to be valuable, but have gone further, and are now using triple and quadruple expansions. The best information concerning the necessity for increasing steam pressure comes from Russia, where considerable economy has been shown from compounding at 125 lbs. The mechanical constructions should in nowise enter into a discussion of the benefits of compounding. Sometimes we hear of a defective compound, but on investigation these defects are found to lie almost wholly in mechanical designs and constructions. There is no difference in the starting power between a well designed compound and a simple locomotive. It is true, however, that the compound has not such a wide range as a simple engine. Compound locomotives should be designed for the work which they are to do. Compounds arranged for passenger service cannot be used economically in another class of work.

Mr. PITKIN: Regarding the Boston & Albany engine, the defect was in the design. I believe in the four-cylinder type, and that any engine of that sort which is well designed will be found to be economical.

Mr. Pitkin being called upon to state experiences with the Michigan Central compound said: This engine is reported to start trains better than a simple engine. I attribute this rather to the cylinder power than to the compound principle. It is impossible to see how this engine can be more expensive in repairs than a simple engine, as the only additional part is the intercepting valve, which has now been running for six months, and has not been taken out. Certainly it can cost no more for repairs than the air pump. The excessive back pressure is a point that should be looked after in a compound locomotive. We had to experiment a great deal, and finally gave the valve ¾ in. inside clearance on both sides. While this reduced considerably the back pressure, it did not cause losses on the steam side of the card at high speed; thus showing there was no objection to a large amount of inside clearance. I regret that we have not had comparative trials of this engine with simple engines of like capacity. In a series of eight experiments, the saving, according to the Superintendent's statement, was 60 per cent. of the fuel used by a 17×24 in. 8-wheel engine in the same service. The great saving is in cylinder condensation, the variation in cylinder temperature being about 150 degrees in a simple engine, and in a compound only 60 degrees to 90 degrees. The superheating effect in a receiver must be very small, as the steam is only one-fifth of a second in transit. The Michigan Central engineers have been trained to regulate by the reverse lever; but this is not wise at short cut-offs in compound engines, and I am of the opinion that a 12-in. cut-off is as short as should be used at high speeds, and we make the cut-off the same in both cylinders. In new engines of the same capacity as the Michigan Central, we shall use 19 × 24 and 29 × 24, instead of 20 × 24 and 29 × 24 as now. We shall make the quadrants without notches between mid-gear and the 8-in. cut-off.

REPORT OF COMMITTEE ON STEEL AND IRON AXLES.

Mr. Mechan, Superintendent Motive Power, Cincinnati, New Orleans & Texas Pacific, has not had any experience with steel axles, but uses various sizes of iron axles.

Mr. McGrayell, Master Mechanic Chicago, Rock Island & Pacific, says the number of steel axles in service is not sufficient to afford an opportunity to judge of their relative values.

Mr. Lacy R. Johnston, Master Mechanic Canadian Pacific, has never had steel axles break under locomotives, but has had two or three break under passenger cars. He gives no data as to the cause of breakage.

Mr. N. W. Sample, Superintendent Motive Power, Denver & Rio Grande R. R., recommends:

	Weight per journal.	Diameter of journal.
Driving axle (steel)	12,000 lbs.	8 in.
Engine truck axle (steel)	5,000 "	5 "
	Capacity.	
Tender and car axle (steel)	60,000 lbs.	4¾ in.

He has not had any experience with iron axles.

Mr. John Campbell, Master Mechanic, Lehigh Valley, says that they do not turn driving axles. They remove them when worn so as to require turning. Mr. Campbell says he is using steel for all passenger locomotives. He finds less trouble from heat, and, therefore, less lubrication is required. He recommends a limit for driving axles (iron or steel), to be regulated by the service.

Mr. G. W. Stevens, Superintendent Motive Power, Lake Shore & Michigan Southern, says that it is his practice to establish standard diameters of driving axles for engines of different weights per journal. From these a reduction is permitted of ¼, ⅜ and ½ in. before axles are condemned; the service of reduction being respectively passenger, freight and switching. With engine and tank trucks the practice is principally confined to one standard diameter, and permitted a reduction of ⅛ in. in passenger service. After this follows freight, with a reduction of ¼ in., and then switching, with a reduction of ⅜ in. With both classes of axles, the plan contemplates a change from one class of service to another, and includes a mileage limit, which precludes further service after being reached, whatever may be the diameter. In other words, two limits are provided, one of size and one of miles, and whichever is first reached precludes the axles from further service in that respective class. The equipment entire is iron axles.

Mr. John Hickey, Master Mechanic Milwaukee, Lake Shore & Western, says: "In considering the diameter of a driving axle we must be governed by the capacity of the cylinder, the boiler pressure and the diameter of the wheel, as well as the weight per journal. In other words, the diameter of the driving axle should be proportioned to the power of the engine, like other parts of the machinery, and this being the case, it will be entirely safe for any customary weight. The diameter of the driving axle, therefore, should be of such size and strength as to meet the power of the piston, rather than be simply able to resist the weight brought upon it. As there is but little difference in the strength of the best quality of iron and a quality of mild steel suitable for axles, there should be little or no difference in their respective diameters when used under like conditions. For engine truck axles, my experience has been that the journals should be of such size as not to permit a greater load than 300 lbs. per square inch of bearing, and that the diameter of journal be not less than 55 per cent. of its length. This rule will hold good for all bearings of railway rolling stock, except locomotive crank pins and driving axles, the size of which must be in keeping with the power of the locomotive. The wear of journals of course depends on the weight per unit of bearing in contact and the material of such bearing; a clear hard brass giving less wear for a given number of miles than softer metal. All other things being equal, we find but very little difference in the wear of steel and iron axles.

From the reports received your committee is unable to make any recommendations as to the value of steel as compared with iron. The members seem to have lost sight of the main question, *i. e.*, safe limit of diameter for driving axles, as called for by circular.

We, therefore, suggest that the whole matter be referred to another committee, and that that committee shall ask for new diameters of all axles and for the weights as given in the circular, and also for the safe limit of diameter; the same to be given in the reduction of diameter, and also on the mileage basis, *i. e.*, steel and iron to be given separately.

JOHN MACKENZIE,
J. S. GRAHAM,
JOHN S. COOK.

Mr. GEORGE GIBBS: We have tried in the last few years several sample sets of steel car axles, and the results have not been satisfactory. Our experience with the crank pins, driving axles and car axles is that steel heats more and wears more rapidly, and does not have as good surface as iron. We therefore use iron in all cases. Our trials were, however, made some years ago, and many claims for improvements have since been made. Besides the heating and the wear, the effect of low temperature and the liability to fracture should be considered.

Mr. SWANSTON: We are using steel almost entirely. There is little difference in the price, and I think we get a much more uniform steel than we used to. We have no seams in steel axles and they run better, and an iron axle free from seams might run better still; but the homogeneity of steel makes a good journal. I think we get a better mileage out of steel than out of iron axles. However, I have iron axles which have exceeded the steel, but they are an exception.

Mr. MCCRUMM: Ten years ago, having had difficulty with seams in wrought iron axles, we built about 40 engines with steel driving axles; we had no trouble from heating, but the wear seemed to be about one-third greater than with iron. I have not seen steel axles which will take a polish like wrought iron. I never have considered steel crank pins as satisfactory, and have nearly always used wrought iron case-hardened. However, some time since I commenced to use a very mild steel case-hardened; the results have been most excellent. A tensile test of the steel before and after case-hardening was as follows: ultimate strength before case-hardening, 57,250 lbs.; elongation, 27 per cent.; after case-hardening, the hardened portion was 80,240 lbs. tensile strength and 9 per cent. elongation. While it would seem that this last material was better adapted to resist bending, after case-hardening, yet I do not wish to undertake to defend it.

The third day's proceedings of the convention will be found on page 461.

Some Old Fashioned Rails.

As a slight contribution to the discussion of the problems before the committee of the American Society of Civil Engineers on standard rail sections we give four sections, one quite recent and three that are very old. Fig. 1 is the standard 66-lb. rail of the Northern Pacific and was recently adopted by the Chicago, Burlington & Quincy as standard for its light sections. The distribution of the metal in this section is, head 44.70 per cent., web, 20.28 per cent.; flange, 35.02 per cent. This is a pretty good example of the modern idea of a rail section. It is interesting to compare it with some of the older sections which were rolled before the theory of very deep heads came in.

The first section rolled by the Pennsylvania Steel Co. was essentially the same as fig. 2, except that it was 67

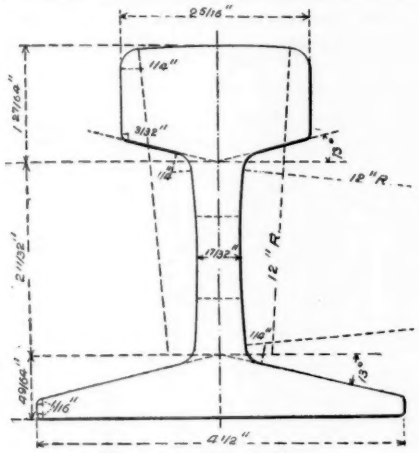
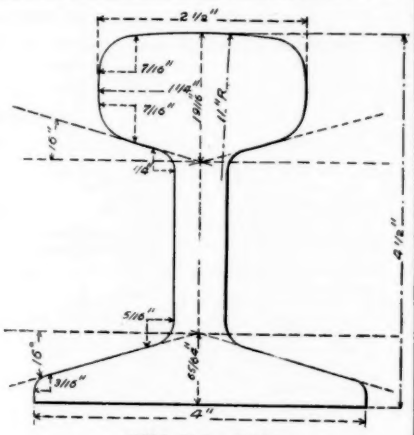


Fig. 1.—66 lbs. per Yard.



(Web, 5/8 in. thick.)

Fig. 2.—69 lbs. per yard.

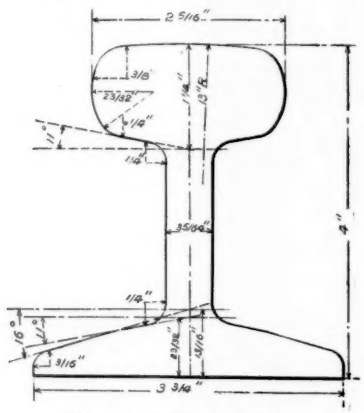


Fig. 3.—56 lbs. per yard.

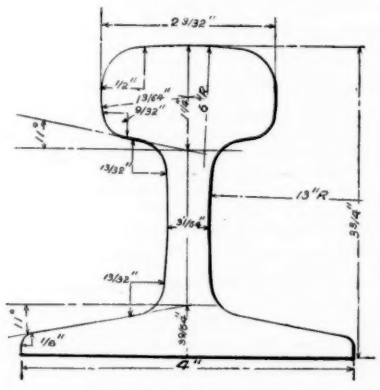


Fig. 4.—50 lbs. per yard.

A STUDY IN RAIL SECTIONS.

lbs. per yard. It has a head designed for rolling at a low temperature, and a thick web. This section was rolled for the Pennsylvania Railroad, and for 19 years gave good service in the main track of that road. Fig. 3 is a section designed by Mr. Heizman, formerly Chief Engineer Pennsylvania Railroad. It closely resembles fig. 2, but has less metal in the head.

The distribution of the material in these two sections, as taken from the printed sections, by the planimeter, is as follows:

	Head.	Web.	Flange.
Fig. 2, per cent	46.50	19.90	33.60
Fig. 3, per cent	43.65	21.47	34.88

Both of these sections gave good service for years, but are now obsolete; the Pennsylvania Steel Co. carries no rolls for them. They were gradually superseded by patterns with relatively deeper heads, and with small lower corner radii and larger fishing surfaces.

Fig. 4 is an interesting example of an early section. This is 50 lbs. per yard and was first rolled for the Central Pacific. It was adopted by many roads at the time when rails cost a good deal and it was necessary to cover the most ground with the least money. The section book of the Pennsylvania Steel Co. gives the names of 21 railroads that used this section, but have now discarded it. It was a favorite section with Southern roads, among others the Richmond, Fredricksburg & Potomac, the Chesapeake & Ohio, the Savannah, Florida & Western, the Richmond & Danville and the Plant Investment Company.

We are informed that "this pattern gave wonderful service, its greatest fault being vertical weakness, . . . but it has on many roads carried an immense traffic with almost inappreciable loss of material from the head. If it had been laid with an unusually large number of ties, it would have outworn sections of much heavier weight, judging from its durability where it has been used." The distribution of metal in this section is: head, 44.40 per cent.; web, 21.28; flange, 34.32.

A Standard Method of Testing Locomotive Engines.*

BY F. W. DEAN.

II.

THE OBSERVATIONS AND RECORD.

Concerning the notes to be taken, it is safe to say that everything conceivable should be noted, for in working up a test many phenomena need explanation and corroboration. The following is given as a sample of pages of a note-book which the writer has found to be satisfactory. A table of the leading dimensions of the locomotive is necessary:

PRELIMINARY NOTES OF TRIPS.

	lbs.
Kind of coal	
Wood used in making fire	
Coal on leaving	
" " arriving	
" used	
" equivalent of wood	
Total fuel used	
Weight of dry ashes, etc., in ash pan	
" " unconsumed coal in ash pan	
" " cinders in smoke box	
Size of exhaust nozzle. (State whether double or single)	
Weather (rainy, snowy, etc.)	
Direction of wind	
Force " "	
Condition of rail	
Temperature of atmosphere	

Also giving a list of cars, and later place their weights opposite to them. Give the number of passengers, and, if practicable, the weight of the baggage.

It is hardly necessary to say that the observer in the cab must be exceedingly vigilant in order to enter properly the items under the various headings.

In working up the tests two tables should be prepared, one devoted to general results and one to cylinder performance. In these tables some quantities may be duplicated. Headings for these tables will be given.

RAILROAD CO.

Tests of locomotive No..... between ..... and ..... miles, leaving .... at .... m. (Date here.)

GENERAL DATA AND RESULTS.

Type of Locomotive. (Enter here a few leading dimensions and weights.) (Space for signature.)

1. Weather
2. Mean temperature of atmosphere
3. Direction of wind
4. Velocity of wind, miles per hour
5. Condition of rail
6. Size of exhaust nozzle (single or double)
7. Weight of train in tons of 2,000 lbs., including locomotive tender, passengers and freight
8. Weight of train in tons of 2,000 lbs., excluding the same
9. Equivalent number of standard cars at —— tons each
10. Maximum boiler pressure by gauge
11. Minimum " " "
12. Average " " "
13. Prevailing position of throttle
14. " " of reverse lever
15. Prevailing points of cut-off, inches. { H. P. cylinder.. / L. P. cylinder..
16. Time made up, minutes
17. Aggregate intermediate stops, minutes
18. Time during which power was developed
19. Actual time in motion
20. Average speed, miles per hour
21. Maximum revolutions per minute
22. Maximum rate of speed, miles per hour
23. Minimum number of seconds per mile
24. Actual weight of coal used, pounds
25. " wood used, pounds
26. Weight of fuel used, including wood, at 4-10 lbs.
27. " " corrected, pounds
28. Average weight of fuel burned per square foot of grate area per hour, pounds
29. Number miles run per ton (2,000 lbs.) of fuel, pounds
30. Number pounds fuel per mile run, pounds
31. Weight of ashes and unconsumed coal in fire-box and ash pan, pounds
32. Weight of unconsumed coal in fire-box and ash pan, pounds
33. " cinders (sparks) in smoke-box, pounds
34. " combustible utilized, pounds
35. Corrected weight of combustible utilized, pounds
36. Percentage of ashes and unconsumed coal in fire-box and ash pan, pounds
37. Percentage of unconsumed coal in fire-box and ash pan, pounds
38. Percentage of cinders in smoke-box, pounds
39. " combustible consumed pounds
40. Average temperature of feed-water
41. Weight of water drawn from tender, pounds
42. Waste of injector, pounds
43. Weight of water evaporated (41-42), pounds
44. Evaporation per pound of total fuel from average temperature of feed-water at average steam pressure, pounds
45. Equivalent evaporation from and at 212 degrees, pounds
46. Equivalent evaporation per pound of combustible from and at 212 degrees, pounds
47. Corrected evaporation per pound of fuel from and at 212 degrees, pounds
48. Corrected evaporation per pound of combustible from and at 212 degrees, pounds
49. Fuel used per ton of train per mile run, pounds
50. Water used " "
51. Water used per hour while developing power, pounds
52. Water used per hour per square foot of heating surface, pounds
53. Maximum I. H. P. developed
54. Average " "
55. Corrected fuel per I. H. P. per hour
56. Water evaporated per I. H. P. per hour
57. Dry steam used per I. H. P. per indicator diagram
58. Average number of square feet of heating surface per I. H. P.
59. Average number of I. H. P. developed per square foot of grate surface
60. Mean temperature in smoke box while working steam
61. Prevailing vacuum in smoke box while working steam

In items 35, 47, 48 and 55 corrections in fuel quantities have been made. This correction was made in 35 by knowing the temperature and weight of the water in the boiler at the time of firing up in the morning, and computing the amount of fuel required to raise the temperature of the water to that of steam of the working pressure and to generate the steam space full of steam at that pressure, and deducting that amount from the total fuel used. If the old fire can be dumped and a new fire immediately lighted, the correction is unnecessary. This last is the best way when practicable. For the above correction assume that 80 per cent. of the calorific value of the fuel enters the water while firing up.

The blank table of cylinder performance is given for a compound locomotive having two cylinders on the Mallet system. It is given for a compound because this is undoubtedly the engine of the future, and it is well to slightly anticipate.

Having now considered most of the matters relating to locomotive tests, it will be interesting to discuss the best method of making a test on a particular piece of railroad. It can be surmised that everybody concerned would prefer to have the results accord with those of every-day practice as nearly as possible. Let us assume a Shore Line express train between Boston and Providence leaving Boston at 10 a. m., arriving at Providence at 11:05 a. m.; leaving Providence on the return trip at 3:20 p. m. and arriving in Boston at 4:30 p. m.; distance, 44 miles, and usual train six cars.

The practice is to bank the fires between trips. Therefore it would seem best to begin the test by dropping the fire at Boston at 7 a. m., and starting a new fire immediately, and to begin charging the new fuel to the trip. Upon arrival at Providence the fire would be banked with a weighed quantity of coal. Upon the return to Boston the fire would be run down to the lowest practicable point, and the coal remaining on the tender would be weighed, the amount subtracted from that placed upon the tender in the morning, and the result would be the coal used upon the trip. The fire could now be banked with a weighed quantity of coal. On the following morning the fire could be got into a condition as near as possible to that of the evening before on arrival, and fresh coal added to be charged to the second day. Now, the trouble with this method is, that in consequence of not dumping the fire entire at the end of the first day the amount of ashes and unconsumed coal in the furnace would not be known; therefore, the amount of combustible and all that depends upon it would not be known. Moreover,

ENTRIES IN NOTE BOOK.

1.		2.		3.	4.	5.	6.	7.	8.	9.	10.	11.	12.	13.	14	15.	16.*	17.	18.	19.	20.
Mile posts.		Cards.		Revolutions per minute.	Steam pressure.	Position of throttle	Throttle opened at.	Throttle closed at.	Reverse lever notch.	Point of cut-off.	Injector applied at.	Height of water in boiler.	Safety valve opened at.	Safety valve closed at.	Pyrometer.	Smoke box vacuum.	Name of station.	Time of departure.	Time of arrival.	Tank reading.	Water used.
No.	Time.	No.	Time.																		

*It is best to enter the names and times of passing stations at which no stops are made.

* It is proper to state that these articles were written before the appointment by the American Society of Mechanical Engineers of a committee to investigate the subject.

_______ Bound, _______ 189__

Dimensions.

RESULTS OF TESTS OF LOCOMOTIVE, NO _______

_______ Railroad Co.

CYLINDER PERFORMANCE.

1 Diameters. H. P. Cyl.	1 Diameters. H. P. Piston Rod.	2 Diameters. L. P. Cyl.	2 Diameters. L. P. Piston Rod.	3 Stroke of Pistons.	4 Cards. No.	4 Cards. Time.	5 Mile Posts. No.	5 Mile Posts. Time.	6 Revs. per Minute.	7 Piston Speed, Feet per Minute.	8 Points of Cut-Off. H. P. Inches of Stroke.	9 Points of Cut-Off. H. P. per cent of Stroke.	10 Points of Cut-Off. L. P. Inches of Stroke.	11 Points of Cut-Off. L. P. per cent. of Stroke.	12 Pressures. Boiler Gauge.	13 Pressures. Left or H. P. Steam Chest.	14 Pressures. Left or H. P. Cyl. Initial.	15 Pressures. Left or H. P. Cyl. Least Back.	16 Pressures. Left or H. P. Cyl. Back at Mid-Stroke.	17 Pressures. Pressure in Receiver.	18 Pressures. Right or L. P. Cyl. Steam Chest.	19 Pressures. Right or L. P. Cyl. Initial.	20 Pressures. Right or L. P. Cyl. Least Back.	21 Pressures. Right or L. P. Cyl. Back at Mid-Stroke.	22 Pressures. Left or H. P. Cyl. Mean Effective Front.	23 Pressures. Left or H. P. Cyl. Mean Effective Back.	24 Pressures. Right or L. P. Cyl. Mean Effective Front.	25 Pressures. Right or L. P. Cyl. Mean Effective Back.	26 Indicated H. Ps. Left or H. P. Cyl.	27 Indicated H. Ps. Right or L. P. Cyl.	28 Indicated H. Ps. Total.	29 Difference between H. P. and L. P.	30 Fuel and Water Consumptions. Fuel per I. H. P. per Hour.	31 Fuel and Water Consumptions. Water per I. H. P. per Hour.	32 Fuel and Water Consumptions. Steam accounted for by Indicator at Release, per I. H. P. per Hour, in L. P. Cyl.	33 Fuel and Water Consumptions. Per Cent. of 32 to 31.	34 Steam accounted for by Indicator at Release, per I. H. P. per Hour in H. P. Cyl.	35 Quality of Steam.	36

TABLE OF RESULTS OF TEST OF LOCOMOTIVE No. 148, OLD COLONY R.R. CO.

TEST CONDUCTED DURING NOVEMBER, 1889, ON "SHORE LINE" EXPRESS TRAINS RUNNING ON THE PROVIDENCE DIVISION, BETWEEN BOSTON AND PROVIDENCE, 44 MILES.

	Saturday, Nov. 2.	Monday, Nov. 4.	Tuesday, Nov. 5.	Wednesday, Nov. 6.	Thursday, Nov. 7.	Friday, Nov. 8.	Monday, Nov. 11.	Sunday, Nov. 17.
1.. Weather	Cloudy.	Clear.	Cloudy.	Clear.	Partly Cloudy.	Cloudy.	Clear Cloudy.	Clear.
2.. Mean temperature of atmosphere	52°	46°	42°	41°	45°	49°	41°	31°
3.. Direction of wind. Southbound.	Rear.	Head.	Side.	Side.	Rear.	Head.	Rear.	Side.
Northbound.	Head.	Side.	Side.	Side.	Side.	Side.	Head.	Side.
4.. Velocity of wind-miles per hour. S.	5	11	16	20	17	8	5	9
N.	10	18	14	14	13	12	8	11
5.. Condition of rail	Good.	Good.	Good.	Good.	Good.	Good.	Good.	Good.
6.. Size of exhaust nozzle, single ... diameter.	4½″	4⅝″	4¾″	4¾″	4¾″	4¾″	4¾″	4¾″
7.. Weight of train in tons of 2,000 lbs., incl. locom. tender, passenger and freight. S.	264	258	264	258	251	258	346	459
N.	258	258	258	253	258	253	340	459
8.. Weight of train in tons of 2,000 lbs., excluding locomotive and tender. S.	183	177	183	178	171	177	265	378
N.	188	188	187	173	177	173	259	378
9.. Equivalent number standard empty O. C. cars at 29 tons. S.	6.31	6.10	6.31	6.10	5 90	6.10	9.11	13
N.	6.48	6.48	6 45	5.96	6 10	5 96	8.93	13
10.. Maximum steam pressure lbs. per sq. in. by gauge. S.	155	146	148	156	166	182	180	180
N.	145	145	141	159	172	180	176	178
11.. Minimum steam pressure lbs. per sq. in. by gauge. S.	135	133	135	138	138	163	122	126
N.	128	132	130	145	149	143	160	123
12.. Average steam pressure. S.	141.5	139.4	139.8	150	158.8	172 6	154.3	163
N.	138.7	138.1	137.5	151.2	159 1	168 8	168.6	155.3
Mean.	140	138.7	138.6	150.6	159 0	170 7	161.5	159.1
13.. Prevailing position of throttle valve	Wide Open.	Wide Open.	Wide Open.	Wide Open.	Wide Open.	Wide Open.	Wide Open.	Wide Open.
14.. Prevailing position of reverse lever. S.	7	7	7	7	7 & 4	4	7	7
N.	7	7	7	7	7	7	7	7 & 10
15.. Prevailing point of cut-off, inches. S.	6⅝	6⅝	6⅝	6⅝	6⅝ & 4⅜	4⅜	6⅝	6⅝
N.	6⅝	6⅝	6⅝	6⅝	6⅝	6⅝	6⅝	6⅝ & 9½
16.. Time made up, minutes. S.	0	4½	¾	1¾	1¼	½	1½	......
N.	0	5½	1¾	6	9	8¾	1¼	......
17.. Aggregate intermediate stops, minutes. S.	¾	2¾	¾	1	1¼	1	¾	0
N.	2¾	3¾	1¾	3	1¾	1½	1½	1
18.. Time during which power was developed, minutes. S.	54¾	49¾	53¼	54¼	49¼	51	55½	61½
N.	52½	52	53¾	53¼	49	49	56	62
19.. Actual time in motion, minutes. S.	64¼	59¼	63½	62¼	62½	63½	62¾	65½
N.	67¼	62½	66½	62¼	60	61¼	67¼	65¼
20.. Average speed-miles per hour, excluding stops. S.	41.1	44.2	41.5	42.4	42.1	41 6	42.1	40.3
N.	39.3	42.2	39.6	42.4	44.1	43.1	39.3	40.5
21.. Maximum Speed. Maximum revolutions per min. S.	282	288	300	312	288	288	288	282
N.	324	364	336	324	376	364	342	348
Maximum rate-miles per hour. S.	57.8	59.1	61.5	63 0	59 1	59.1	59.1	57.8
N.	66.5	74.7	68.9	66.5	77 1	74.7	70 2	71.4
Minimum number seconds per mile. S.	62.2	60.9	58.5	56.3	60.9	60 9	60.9	62.2
N.	54.2	48.2	52.2	54 2	46.7	48 2	51.3	50.4
22.. Actual weight of coal used, lbs.	5.019	4,928	4,275	4,718	4,683	4,701	6,644	7,455
23.. Actual weight of wood used, lbs.	692	880	631	754	743	829	917	524
24.. Weight of fuel used, wood at 4-10 lbs.	5,296	5,280	4,527	5,020	4,980	5,033	7,011	7,665
25.. Weight of fuel used, corrected, lbs.	4.914	4,680	4,145	4,638	4,598	4.651	6,290	7,283
26.. Fuel burned per sq. ft. grate per hour, lbs.	113.6	113.8	97.8	112.7	114.4	114.1	148.3	172.5
27.. Number miles run per ton (2,000 lbs.) of fuel.	33.2	33.3	38.9	35.1	35.3	35.0	25.1	23.0
28.. Number lbs. fuel per mile run.	60.2	60 0	51 4	57.0	56.6	57.2	79 7	87 1
29.. Weight of ashes and unconsumed coal, lbs.	570	368	382	420	408	417	482	717
30.. Weight of cinders in smoke box, lbs.	579	551	395	460	455	449	651	776
31.. Weight of combustible utilized, lbs.	4,147	4,361	3,758	4,140	4,117	4,167	5,878	6,172
32.. Corrected weight of combustible used, lbs.	3.848	3,866	3,432	3,826	3,803	3,851	5,271	5,863
33.. Percentage of ashes and unconsumed coal.	10.8	7.0	8.4	8.4	8.2	8.3	6.9	9.4
34.. Percentage of cinders in smoke-box.	11.5	11.2	9.2	9.7	9.7	9.6	9.8	10.4
35.. Percentage of combustible in coal.	78.3	82 6	82.8	82 5	82.7	82.8	83.8	80.5
36.. Average temperature of feed-water.	56°	55°	55°	54°	53°	52°	53°	50°
37.. Weight of water evaporated, lbs. S.	16,170	14,567	15,812	15,187	14,357	13,493	18,783	21,453
N.	17,084	14,777	11,829	12,931	12,835	14,250	15,750	19,312
Total.	33,254	29,344	27,641	28,118	27,192	27,743	34,533	40,765
38.. Waste of injector, lbs. S.	81	58	63	63	81	69	92	110
N.	40	98	46	69	52	63	63	63
39.. Evaporation per lb. total fuel from average temperature of feed at average steam pressure.	6.28	5.56	6.11	5.60	5.46	5.51	4.93	5.32
40.. Equivalent evaporation from and at 212°.	7.60	6.74	7.39	6.79	6.62	6.70	6.01	6.47
41.. Equivalent evaporation per lb. combustible from and at 212°.	9.70	8.16	8.92	8.24	8.01	8.09	7.21	8.03
42.. Corrected evaporation per lb. fuel from and at 212°.	8.19	7.62	8.07	7.34	7.17	7.25	6.70	6 81
43.. Corrected evaporation per lb. combustible from and at 212°.	10.45	9.22	9.74	8.92	8.67	8.75	8.04	8.45
44.. Lbs. fuel per ton of train per mile run.	0 32	0.33	0.28	0.32	0.32	0 29	0 30	0.23
45.. Lbs. water per ton of train per mile run. S.	2.10	1.87	1.96	1.94	1.91	1.73	1 61	1.21
N.	2.06	1.74	1.44	1.70	1.65	1 87	1.38	1.16
46.. Lbs. water per hour (thr. valve open) per sq. ft. heating surface. S.	12.24	12.13	12.30	11.60	12.08	10.42	14.02	14.45
N.	13.48	11.78	9.12	10.06	10.85	12.05	11 65	12.91
47.. Maximum I. H. P. developed. S.	....	781	721	788	769	789	921	906
N.	....	886	670	981	940	956	1,052	914
48.. Average I. H. P. S.	....	557.3	521.7	563.4	574.1	521.1	683.3	688.7
N.	....	616.8	540.6	590.6	668.8	719.3	734.7	687.8
Mean for round trip.	....	593.5	529.3	576.7	619.1	620.1	709.9	688.2
49.. Lbs. corrected fuel per I. H. P. per hour.	....	4 64	4.38	4.46	4.50	4.50	4.77	5.30
50.. Lbs. water per I. H. P. per hour. S.	....	31.52	34.13	29.81	30.47	30.46	29.72	30.39
N.	....	27.64	24.43	24.67	23.50	24.26	22.97	27.17
51.. Lbs. water per I. H. P. per hour for round trip.	....	29.1	29.2	27.1	26.6	26.8	26.4	29.6
Lbs. steam per I. H. P. per hour by diagram.	....	19 5	....	....	to	....	....	17.7
52.. Average number sq. ft. of heating-surface per I. H. P. S.	....	2.60	2.78	2 57	2.52	2.78	2.12	2.10
N.	....	2.35	2.68	2.45	2.17	2.01	1 97	2.12
53.. Number I. H. P. developed per sq. ft. of grate surface. S.	....	29.0	27.1	29 3	29.9	27.1	35.5	35.8
N.	....	32.1	28.1	30 7	34.8	37.4	38.2	35.8

NOTE.—Corrected weights of fuel and combustible denote that a deduction from the actual consumption has been made for the amount required to heat the water in the morning. Water consumptions of northbound trips are more reliable than those of southbound, because there was less blowing-off before starting. The fuel quantities given for Nov. 17 include coal used for banking one night.

it would be impossible to get the fire on the second morning in the exact condition of the night before after shaking down, and therefore some coal which was charged to banking would be fuel for the second day's run, or some of the new coal would perform the service of banking coal. The result, while good enough for all practical purposes, would be discredited, and the person making the test would be severely criticised.

It seems to the writer that the more this matter is considered the more convincing it is that each day's test should be entirely separate from the others. He therefore would make the test in the following manner:

On the first day drop the old fire at Boston at 7 a. m., and immediately build a new one with a weighed quantity of wood, which will be charged as coal at $\frac{4}{10}$ its weight. All coal will be charged to the trip, including that used at Providence for banking. On the return trip run the fire down as low as possible on approaching Boston, consistent with making the time. On reaching the roundhouse, immediately drop the fire and weigh the contents of the ash pan and smoke box, all in a dry state if practicable. We thus have this day's performance complete by itself.

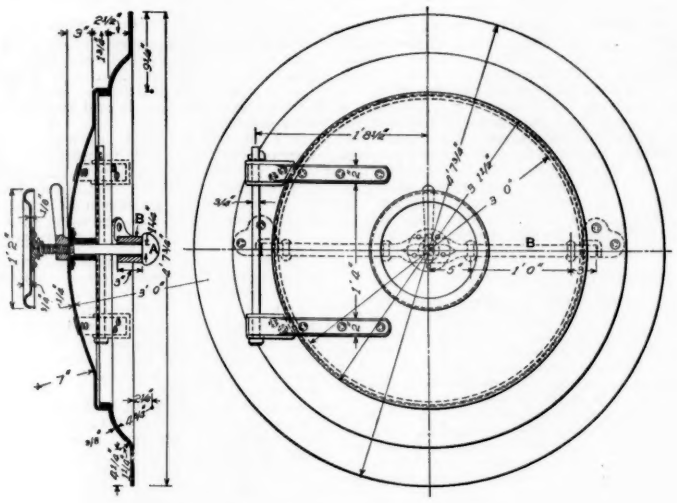
We can now or later start a fire which is solely for keeping the water hot until 7 a. m. of the next day, when it would be dumped and a new fire lighted, and the test made as on the first day. Or, there need be no fire kept overnight, the engine being kept as hot as practicable by closing all dampers and doors. In this case the temperature of the water in the boiler should be taken when starting the fire in order to obtain data for computing the fuel correction, explained previously. Stated concisely, it is the writers' belief that in a locomotive test each day's performance should be separately considered and noted, and that any other method leads to inaccuracy.

Locomotive Boiler Front of Pressed Steel.

One of the attractive exhibits at the Old Point Conventions was the pressed steel locomotive boiler front shown herewith. It was made by the new machinery recently put into operation by the Fox Solid Pressed Steel Co. at Joliet, Ill. Many of these of smaller size and special design are in use on the Manhattan Elevated, and several of this size are used on roads centering in Chicago. The new class "I" engine on the Burlington has one, and its smooth, light appearance adds no little to the appearance of general good finish of that machine.

The front is made ⅜ in. and the door ½ in. in thickness. The front is bolted on as usual and the door swings on wrought iron hinges and malleable iron brackets with one long hinge pin, as shown.

The number plate is also of pressed steel. It is attached to the door by a long, loosely fitted bolt having a T head at *A*. To this bolt the plate is securely fastened by a screw thread and a pin, as shown, the malleable iron washer on the back of the plate serving as a nut for the long bolt. The T head on the bolt is of the proper dimension to pass through the brace bar on the inside,



BOILER FRONT OF PRESSED STEEL.

Made by the FOX SOLID PRESSED STEEL CO., *Chicago.*

shown at *B*. This bar is formed of two pieces of flat iron riveted together and spread apart at the centre to allow the T head to pass through the opening, when that head is turned at right angles to the position shown. The brace bar rests in a cast bracket at each end, the bracket being riveted to the front. Outside of the door there is a handle nut which, when screwed down hard holds the door tightly closed.

To open the front one slacks off the handle nut and turns the number plate 90 degrees in either direction. This brings the T head of the clamp bolt into the proper position to pass through the space between the bars and the door is unfastened. The brace bar is easily lifted from the brackets to allow a workman to enter the arch. In making this class of work the dies are all turned out and finished with the result of leaving all surfaces plain, smooth and free from pitholes and rough places. This accuracy of preparation of the dies renders it possible to make the work sufficiently accurate to be used without turning. The joint between the door and the front is a most important one, and it must be made tight to prevent losses in the effect of the draft on the fire and also to prevent the cinders in the front from igniting. These fronts are tight, as they are put together after being trimmed when taken from the dies.

The steel used is of a quality that will flange, and the weight of the whole front is about 30 per cent. of the cast-iron one commonly used. Every pound that can be removed from the front truck of some prevailing types of engines is worth saving, hence a boiler front that is smooth, well-finished and light is sure to receive attention.

Train Accidents in May.

COLLISIONS.

REAR.

3d, on Texas & Pacific, near Aubrey, Tex., a passenger train ran into the rear of a freight train, damaging engine, caboose and three cars.

4th, on Pittsburgh, Cincinnati & St. Louis, at Reading, O., freight train ran into the rear of another freight in a fog, disabling engine and damaging caboose.

4th, on Allegheny Valley road, in Pittsburgh, Pa., a passenger train ran over a misplaced switch and into some freight cars standing on a siding, doing some damage.

5th, on New York Central & Hudson River, at Schenectady, N. Y., collision between a westbound passenger train and a locomotive, doing slight damage. Engineer hurt.

6th, on New York, Lake Erie & Western, at Painted Post, N. Y., westbound Lehigh Valley passenger train, No. 23, ran into the rear of a work train, doing considerable damage. Engineer, fireman, and four passengers hurt.

9th, on Southern Pacific, near Altamont, Cal., a special officers' train ran into the rear of a gravel train in a tunnel, wrecking several cars, and killing one brakeman.

9th, on Missouri, Kansas & Texas, near Taylor, Tex., passenger train ran over a misplaced switch and into a gravel train standing on a siding, wrecking engine and three cars. Engineer and fireman injured.

10th, on Louisville and Nashville, near Helena, Ala., through freight train No. 73 collided with a work train, wrecking both engines and several cars. A man in the caboose without authority was killed and another injured. It is said that one of the trains ran past a red flag.

12th, on Pittsburgh, Cincinnati & St. Louis, near Jewett, O., a freight train broke in two and the detached portions afterward collided, wrecking 15 cars.

12th, on Cincinnati, Hamilton & Dayton, at New Palestine, Ind., a fast passenger train ran over a misplaced switch and into some freight cars standing on a siding, wrecking four freight cars and badly damaging a parlor car. Conductor, porter and three passengers injured.

12th, on Ohio & Mississippi, at Bridgeport, Ill., a fast freight train ran into a freight car which had been blown out of a siding by high wind. Eight cars wrecked and the engineer and fireman injured.

13th, on Cleveland, Cincinnati, Chicago & St. Louis, near Sedansville, Ind., a freight train ran into the rear of another freight, wrecking engine, caboose and four cars.

13th, on Missouri Pacific, in St. Louis, Mo., engine of a switching freight train ran over a misplaced switch and into some cars standing on a side track, wrecking several of them. A brakeman and one other person injured.

13th, night, on East Tennessee, Virginia & Georgia, at Pinsons, Ga., freight train ran into the rear of a preceding freight, wrecking an engine and 13 cars and injuring the engineer. The wreck took fire and was burned up.

14th, on New York, Lake Erie & Western, near Abbot Road, N. Y., a freight train ran into the rear portion of a preceding train which had broken in two, wrecking engine and seven cars. Fireman injured.

14th, on Beach Creek Railroad, near Munsons, Pa., freight train ran into the rear of a work train, killing two employés and injuring several others.

14th, evening, on Chicago & Northwestern, near Elgin, Ill., a fast passenger train ran into the rear of a gravel train, wrecking both engines and a number of cars. The engineer was badly injured. A misplaced switch is said to have been the cause.

14th, night, on Buffalo & Southwestern, near Hamburg, N. Y., freight train ran into the rear of a preceding freight, wrecking engine and several cars. The foremost train had broken in two and the rear portion was standing on an ascending grade. A boy stealing a ride was killed.

16th, on Philadelphia & Reading, at Reading, Pa., a freight train ran over a misplaced switch and into some cars standing on a siding. One brakeman killed.

16th, on Chicago & Eastern Illinois, near Broadland, Ill., a pay car train ran into the rear of a passenger train on a curve, killing one passenger and injuring several others.

20th, on Cleveland, Lorain & Wheeling, at Millport, O., a freight train ran into the rear of a construction train, derailing and damaging engine and several cars.

20th, 6 a. m., on Chicago & Alton, at Mexico, Mo., a freight train standing in the yard was run into at the rear by a following freight approaching on the down grade. Engine and several loaded cars wrecked.

A third freight soon after ran into the second one, derailing several cars.

20th, on Denver, Texas & Fort Worth, at Denver, Colo., a passenger train ran into a switching freight, badly damaging engine and one car. The passenger train was two hours late, and it is stated that the night yard crew "were not aware of the fact."

21st, on Delaware & Hudson Canal Co.'s road, at Albany, N. Y., a West Shore passenger train was run into at the rear by a freight train. Locomotive and rear coach damaged.

21st, night, on Boston & Albany, near Worcester Mass., a freight train descending a grade broke in two and the rear part ran into the forward one, wrecking 12 cars. One brakeman injured.

21st, on Pittsburgh & Western, near Aliquippa, Pa., a freight train ran into the rear of a work train, which, in going on to a siding to get out of the way of the former, was broken in two. There was a dense fog at the time, and the break was not promptly discovered by the trainmen. The engineer of the work train was killed and the conductor, fireman and one brakeman injured.

22d, night, on East Tennessee, Virginia & Georgia, near Shannon, Ga., a freight train ran into the rear of a preceding freight, wrecking several cars and killing a tramp.

24th, on New York, Chicago & St. Louis, at Silver Creek, N. Y., freight train ran into the rear portion of another freight which had been stopped on an ascending grade. Two cars wrecked.

24th, on Texas & Pacific, near Dodd City, Tex., a freight train broke in two and the rear portion ran into the forward one, wrecking five loaded cars. Brakeman injured by jumping.

24th, 3 a. m., on Atchison, Topeka & Santa Fé, at Pawnee, Kan., passenger train running 30 miles an hour struck some freight cars which had been blown from a siding by a high wind. Engine and one freight car badly damaged. Engineer and fireman hurt by jumping.

26th, on Burlington, Cedar Rapids & Northern, at Muscatine, Ia., a passenger train was run into at the rear by a freight train, damaging several coaches.

27th, 3 a. m., on Lehigh Valley, near Slatington, Pa., a coal train ran into the rear of a freight which had broken in two, wrecking 12 cars. The engineer and two other trainmen were injured. The same engine was damaged and the same fireman was injured in a collision near the same place on April 27.

27th, on Louisville, Evansville & St. Louis, near Huntingburg, Ind., a freight train broke into three parts, and the middle portion ran back into the rear one, derailing several cars and injuring four men riding in them to care for live stock.

28th, on Louisville & Nashville, near Zion, Ky., a passenger train ran into some cars of a construction train standing on the main track, injuring 2 workmen.

28th, on Pennsylvania, near Pittsburgh, Pa., an eastbound freight ran into the rear of a preceding freight which had stopped unexpectedly, wrecking engine and several cars. The wreck blocked the westbound track and was run into by a gravel train from the east, blocking all the main tracks. Engineer badly hurt.

29th, on Pennsylvania road, near Bolivar, Pa., a freight train broke in two and the rear portion afterwards ran into the front part, wrecking 2 cars.

30th, 1 a. m., on Union Pacific, at North Platte, Neb., limited express drawn by two engines ran into a yard engine, wrecking three locomotives and killing an engineer. One fireman injured.

31st, on Pennsylvania, near Phillipsburgh, N. J., empty engine ran into the rear of a gravel train, killing the conductor and one laborer, and injuring four other laborers. It is said that the empty engine was running contrary to orders.

31st, on Burlington & Missouri River, at Twenty-fourth street, Omaha, Neb., passenger train ran over a misplaced switch, and into some freight cars standing on a siding, damaging engine and derailing one car. Conductor and two passengers injured.

BUTTING.

6th, on New York, Pennsylvania & Ohio, at Millers, N. Y., butting collision between two freight trains, wrecking both engines and 15 cars. It is said that an operator neglected to hold one of the trains. The engineer was injured by jumping.

10th, on St. Louis & San Francisco, near Monett, Mo., butting collision between two freights, wrecking both engines and several cars. Engineer and fireman killed.

10th, on Missouri, Kansas & Texas, near Dennison, Tex., butting collision between freight trains, wrecking two engines and six cars. The engineer was injured. It is said that a mistake in giving orders was the cause.

12th, on East Tennessee, Virginia & Georgia, near Chattanooga, Tenn., butting collision between freight trains, killing an engineer, two firemen and two brakemen. It is said that a misunderstanding of orders was the cause. There was a dense fog at the time.

13th, on Gulf, Colorado & Santa Fe, near Belleville, Tex., butting collision between two freight trains, wrecking the engines and 13 cars. Fireman killed, engineer injured.

16th, night, on Pittsburgh & Lake Erie, at Wampum, Pa., butting collision between freight trains 49 and third 52, both engines and 10 cars being wrecked. One of the trains neglected to stop at the appointed meeting place.

17th, on East Tennessee, Virginia & Georgia, near Jesup, Ga., butting collision between a freight and a work train, injuring one engineer and both firemen.

18th, on Pittsburgh & Western, near Niles, O., butting collision between two freights, wrecking both engines and 20 cars. Brakeman killed. Failure of an operator in delivering orders is given as the cause.

19th, on Illinois Central, near Remsen, Ia., butting collision between two freight trains, doing considerable damage and injuring an engineer.

20th, on Little Rock & Fort Smith at Menifee, Ark., a freight train ran over a misplaced switch and into the head of a work train standing on a siding, badly damaging a dozen cars. A fireman was injured by jumping.

21st, on Chicago, Milwaukee & St. Paul, near Dedham, Ia., butting collision between a passenger train and a work train. Both engines, baggage car and five platform cars badly damaged; fireman killed and baggagemaster injured.

22d, on Chesapeake & Ohio, near Scottsville, Va., butting collision between freight trains, wrecking both engines and 15 cars. A telegraph operator, in receiving an order for one of the trains which was also addressed to another section of the same train, made a mistake in the address and delivered copies to one train only instead of two.

23d, on New York, New Haven & Hartford, at South Lyme, Conn., butting collision between two gravel trains. The engine of one of the trains was pushing the caboose. One laborer was killed and three injured. It appears that the conductors of these trains made meeting points verbally upon their own responsibility, which a coroner's verdict says was "without the knowledge of the railroad company." The coroner's verdict also says that each engineer on approaching the curve where the collision occurred blew a long blast of the whistle, and that very likely these signals were simultaneous, so that neither heard the whistle of the other.

24th, on Chicago & Northwestern, at Logan, Ia., butting collision between passenger trains 2 and 3. Engineer and baggageman injured. The trains had orders to meet at Logan; in approaching the station around a curve, the fireman on No. 2 thought the track was clear and so told his engineer, who was on the outside of curve; the engineer then let off the brakes and the train ran at about ten miles an hour into train No. 3, which was at the platform.

24th, on St. Louis, Vandalia & Terre Haute, near Troy, Ill., butting collision between an eastbound cattle train and a westbound local freight, both running rapidly. Both engines and 10 cars wrecked, a brakeman killed and four other trainmen injured.

25th, on East Tennessee, Virginia & Georgia, near McDonald, Ala., butting collision between passenger train No. 3 and a freight train No. 24, wrecking both engines and several cars. Engineers, two mail agents and one passenger injured. It is said that the passenger conductor and engineer had orders to wait at McDonald, but failed to do so.

27th, on Pennsylvania, at Camden, N. J., butting collision between two yard engines.

28th, night, on joint track of Old Colony and New York, Providence & Boston, at Woodlawn, R. I., butting collision between freight trains, owing to a misplaced switch. A number of cars were badly wrecked and the main track blocked for several hours.

28th, 8 p. m., on Richmond & Petersburg, at Richmond, Va., an excursion train of 14 cars, heavily loaded, approaching Richmond from the south, struck a switching engine on the high bridge over the James River, damaging both engines and injuring one of the engineers, who was badly scalded and had a leg broken.

CROSSING AND MISCELLANEOUS.

2d, at Columbus Grove, O., Cincinnati, Hamilton & Dayton freight train ran into the rear end of Pittsburgh, Akron & Western construction train, doing some damage.

5th, on Chicago & Atlantic, at Marion, O., a yard engine in making a flying switch collided with some freight cars, doing some damage and badly injuring engineer and fireman.

6th, on Boston & Maine, at Nashua, N. H., collision between freight trains, due to a mistake in signaling, wrecking a number of cars.

7th, on Housatonic road, near Danbury, Conn., a passenger train ran into a freight car which projected over the main track from a siding, doing considerable damage. Two trainmen were thrown from the train and injured, and a newsboy who was thrown into an open doorway in the baggage car was caught by the door and killed.

7th, 6 a. m., at Allentown, Pa., a Central of New Jersey passenger train ran into a Lehigh Valley passenger

train which was slowly moving over the crossing of the two roads near the station. Two cars were overturned and two passengers were killed and six injured. The fireman of the Central train jumped and was injured. The braking power of the Central train was inadequate for a quick stop, and, besides this, the engineer failed to properly control his speed. The track was somewhat slippery.

18th, on Cleveland, Lorain & Wheeling, at Maynard, O., a freight train was struck and may cars wrecked by seven cars of coal which came uncontrolled down a siding from a coal mine.

20th, night, on Pennsylvania, at Elizabeth Furnace, Pa., a westbound freight train ran into an eastbound freight which was pulling through a crossover, demolishing an engine and six cars of dressed beef and 10 cars of the westbound train. The wreck took fire, but the flames were soon extinguished. The track was blocked all night, and an engineer was killed and two brakemen injured.

23d, at Sheffield, Mo., a Chicago & Alton passenger train crossing the tracks of the Missouri Pacific at high speed was struck by the engine of a freight train of the latter road, one sleeping car being completely wrecked and the rest of the passenger cars being overturned down an embankment 15 ft. high. Only eight passengers were injured, however, and none killed. The engineer of the Alton train failed to apply his brake in proper season and approached the crossing at undue speed after the freight had received the right of way; then seeing his dilemma, he applied steam and tried to get over the crossing before the freight.

24th, at crossing near Eldred, Pa., collision between New York, Pennsylvania & Ohio and Bradford, Eldred & Cuba freight trains, wrecking both engines. Engineer badly hurt.

DERAILMENTS.

DEFECTS OF ROAD.

1st, on Columbus, Hocking Valley & Toledo, at Ackerman, O., seven cars of a freight train were derailed by a defective switch.

4th, on Great Northern, near St. Francis, Minn., a freight train ran upon a burning bridge, and was precipitated into the stream 12 ft. below. Ten cars were wrecked, and the engineer and fireman had a very narrow escape.

9th, on Illinois Central, near Le Mars, Ia., a bridge gave way under a freight train, and 13 cars went down into a creek in a bad wreck.

9th, on Chicago, Burlington & Quincy, at Wyanet, Ill., a freight train running 25 miles an hour was derailed at a defective switch. Eight cars were totally wrecked, and the engineer, fireman and one brakeman were killed.

11th, on Cincinnati, Hamilton & Dayton, near Pottstown, O., several cars of a freight train were thrown from the track by the spreading of the rails.

14th, on Southern Pacific, near Alviso, Cal., the engine, baggage car and one coach of a passenger train were thrown from the track by the spreading of the rails. Engineer and fireman injured.

20th, on Upper Coos Railroad, near North Stratford, N. H., a work train ran upon a bridge whose supports had been weakened by a freshet, and the engine and tender were precipitated into the stream. The Superintendent of the road and one laborer were killed.

23d, on Columbus & Greenville, at Greenville, Ga., engine of freight train derailed by the spreading of the rails and overturned, injuring the fireman.

24th, on New York & New England, at Thompson, Conn., a car in a freight train was derailed at a defective switch and thrown over on the opposite track in front of another train, damaging the engine. Engineer injured by jumping.

25th, on Missouri, Kansas & Texas, near Paola, Kan., freight train derailed by a defective switch, engine and six cars being wrecked. Engineer and fireman killed and a brakeman injured. A construction train standing on the side-track was struck and one laborer injured.

DEFECTS OF EQUIPMENT.

3d, on Baltimore & Ohio, at Coultersville, Pa., a car in an eastbound freight train broke down and was thrown in front of an opposite-bound passenger train. The passenger engine, several coaches and six freight cars were wrecked. Two trainmen injured.

7th, on Atchison, Topeka & Santa Fe, near Wellington, Kan., the engine of a freight train exploded its boiler while crossing a small bridge, which gave way under the shock, causing 16 cars loaded with cattle to go down 15 ft. into the creek below. Engineer killed and fireman injured.

12th, on Denver, Texas & Gulf, near Denver, Col., a stock train was derailed by a broken axle and eight cars were ditched.

12th, on Union Pacific, near Brighton, Col., fast freight train derailed by the breaking of an axle, overturning and wrecking a dozen cars.

15th, on Southern Pacific, near Clackamas, Ore., five cars of a freight derailed by a broken brake-beam.

30th, on Grand Rapids & Indiana, at Kalamazoo, Mich., seven cars of a freight train were derailed and wrecked by the dropping of a brake-beam.

30th, on Atlantic & Pacific, near Albuquerque, N. M., freight train derailed by a broken truck. The train was loaded with sheep in double-decked cars and about 1,000 sheep were killed.

NEGLIGENCE IN OPERATING.

3d, on Boston & Maine, at Passumpsic, Vt., engine and tender derailed by a misplaced switch and overturned. Engineer hurt.

7th, on Denver & Rio Grande, at Fountain, Col., a passenger train was derailed by a misplaced switch and the engine and several cars went over a 14-ft. embankment. Fireman killed and several other trainmen injured.

19th, on Philadelphia, Wilmington & Baltimore, near Kirkwood, Del., a freight train ran into an open drawbridge at about four miles an hour. The engine fell about 50 ft. and struck a barge loaded with coal, both going to the bottom of the river. Thirteen cars also plunged into the opening and nine of them were submerged. Several cars were loaded with sheep, but most of the animals were uninjured. The bridge was uninjured and traffic was resumed in about six hours.

30th, on Southern Pacific, South Pacific Coast Division, at Oakland, Cal., a passenger train consisting of engine and one passenger car of a train of three ran into San Antonio Creek, the drawbridge at that point having been opened and only partially closed. Thirteen passengers were drowned. The engineer (Dunn) and fireman jumped off and saved themselves. The danger signal in use at this place consisted of a small red flag upon a stick which was fixed upright in a sleeper between the rails on the end of the fixed span next the draw. The train approached the bridge on a curve turning to the left, and this flag is not plainly visible to the engineer until he gets within about 150 ft. of it; but in clear weather the bridge is in full view from the left-hand side of the engine for nearly a mile, and there was no excuse for the engineer not seeing that the bridge was open in this case. A witness states that this train ran side by side with another one on an adjoining track for some distance, and that the two engineers were engaged in sport, the men on the other train turning a small hose on Dunn, and that the latter increased his speed to get away from the other train. The draw had been revolved to within about 15 ft. of its closed position when the train struck it, and prevented the last two cars from going over. The train was running about 15 miles an hour when the engineer saw the situation and reversed his engine, which was within less than 200 feet of the draw. This accident was reported in the *Railroad Gazette* of June 6, page 400.

UNFORESEEN OBSTRUCTIONS.

4th, on International & Great Northern, near Willis, Tex., a passenger train ran over a cow, derailing the forward portion of the train. Three trainmen injured.

4th, on Columbia & Puget Sound, near Franklin, Wash., a passenger train running backwarks on a short branch was derailed by a hog, the foremost car, as the train was pushed, being a light caboose.

8th, night, on Chicago, Milwaukee & St. Paul, near Andover, S. D., a freight train was wrecked by striking a drove of horses which attempted to cross a bridge and got caught in the sleepers. The engineer was killed.

12th, on Union Pacific, near Pleasant Valley, Ore., engine of passenger train derailed by a spike which had been maliciously laid upon the train. The engine was overturned.

12th, on Philadelphia & Reading, near Dauphin, Pa., engine of freight train derailed by cattle on track and thrown down a 25-ft. embankment into a swamp.

12th, night, on Pennsylvania, at Loyalhanna, Pa., 20 cars of a coke train derailed and wrecked by a misplaced switch. The engineer was badly hurt. The switch is believed to have been maliciously misplaced, and two men were at the time under arrest for having tampered with the same switch a few weeks previously.

16th, on Union Pacific, near The Dalles, Ore., eastbound fast mail derailed by sand on the track, engine and tender being overturned. Engineer, fireman and one passenger injured.

20th, on Delaware & Hudson Canal Co.'s road, at Douglass, N. Y., a freight train ran into a landslide, wrecking engine and eight cars. Fireman injured.

20th, on West Shore, near Highland, N. Y., freight train No. 74 derailed and engine and three cars wrecked by a mass of rock which had fallen upon the track.

22d, on New York, Chicago, & St. Louis, near Crayton, O., a freight train was derailed at a washout and 30 cars were wrecked. Engineer and several other trainmen injured.

24th, on Pennsylvania, near Shawmont, Pa., engine of passenger train derailed by a sleeper which had been placed upon the track.

25th, on New York Central & Hudson River, near Whitesboro, N. Y., freight train derailed by a washout, caused by a big break in the Erie Canal. Twenty cars were ditched.

26th, night, on Atlantic Coast Line, near Columbia, S. C., two cars in northbound express train 51 derailed and thrown down an embankment at a washout. The cars were badly wrecked and the conductor and three passengers injured. The train was running about 20 miles an hour.

29th, 4 p. m., on Cleveland, Cincinnati, Chicago & St. Louis, near Harrisburg, Ill., engine and eight cars of a freight train derailed and wrecked by running over a steer. Fireman and brakeman badly injured.

UNEXPLAINED.

5th, on Louisville & Nashville, near Cincinnati, O., a car of a freight train was derailed.

5th, on Gulf, Colorado & Santa Fe, near Berwyn, I. T., 15 cars of a freight train were derailed and ditched. Brakeman injured.

8th, on Georgia Railroad, at Crawfordsville, Ga., a car in a freight train was derailed, wrecking several others and blocking the track all night.

9th, on Southern Pacific, near Blanco, Tex., an eastbound fast freight train was derailed and several cars ditched.

10th, night, on Union Pacific, near Aspen, Wy., fast mail train derailed. The train was running rapidly and the cars were badly wrecked. Engineer killed.

12th, on St. Louis, Kansas City & Colorado, near Clayton, Mo., a freight train was derailed just before reaching a high trestle, and the engine tumbled off the side of the trestle and was wrecked. Several freight cars went with it, and the road was blocked all day. The engineer and conductor were killed and the fireman was injured.

12th, on Illinois Central, near Calhoun, Miss., a freight train was derailed and several cars ditched.

13th, evening, on Southern Pacific, near Suisun, Cal., westbound passenger train No. 4 was derailed, engine, baggage car and two mail cars being ditched.

15th, on Montana Union road, near Butte, Mont., eastbound passenger train derailed, the sleeping car being thrown down an embankment. Three passengers were killed and one injured.

16th, on Baltimore & Ohio, near Valley Falls, W. Va., tender of a special officers' train was derailed.

17th, on Chicago & Alton, near Joliet, Ill., freight train derailed, piling up 20 cars in a bad wreck.

17th, on Baltimore & Ohio, at Washington Junction, Md., a passenger train was derailed at a switch and struck the engine of a standing passenger train on a side track, disabling both locomotives and damaging several cars.

17th, on Louisville & Nashville, near Danville, Ky., five cars of a freight derailed and wrecked. Engineer, fireman and brakeman killed.

22d, 3 a. m., on Boston & Maine, at Nashua, N. H., a car in a circus train jumped the track and caused the derailment and partial wrecking of a number of other cars.

23d, on Atlantic & Pacific, near Flagstaff, Ariz., engine of special passenger train derailed and overturned. The two passenger cars were also derailed and the occupants, including C. P. Huntington, were badly shaken up.

26th, on Rio Grande Western, near Soldier Summit, Utah, two engines and six cars of a freight train derailed and thrown into a deep cañon, completely wrecking the whole. The trainmen jumped while the train was going at very high speed and six of them were very badly injured. The train was descending a steep grade and was equipped with air brakes. Either the braking power was insufficient or was improperly managed.

27th, on Central of Georgia, near Davisboro, Ga., passenger train derailed while running at speed. All the cars were overturned in a cut, but no one was seriously injured.

27th, on New York & New England, at Hartford, Conn., engine of passenger train derailed.

30th, on New York Central & Hudson River, near Macedon, N. Y., car on a westbound freight train jumped the track and fouled track No. 1. An eastbound freight train ran into it and an engine and several cars were ditched.

30th, on Union Pacific, at Weir, Neb., engine and two baggage cars of an eastbound passenger train derailed.

31st, on Missouri Pacific, in St. Louis, Mo., several cars of a freight train were derailed and knocked down some of the supports of an overhead bridge, causing a portion of the structure to fall, crushing four cars.

OTHER ACCIDENTS.

3d, on Bangor & Piscataquis road, near Henderson, Me., engine of a freight train exploded its boiler, injuring the engineer and fireman.

11th, 2 p. m., on Lehigh Valley, in Buffalo, N. Y., boiler of a locomotive of a switching freight train, running at a moderate speed, exploded, completely wrecking the engine and killing the engineer and fireman. A careful examination of the wreck failed to disclose any defect in the boiler.

13th, on Philadelphia & Reading, near Shamokin, Pa., the engine of a freight train exploded its boiler, killing the engineer, fireman, and conductor. Water was noticed leaking into the firebox before the explosion, but the fireman had barely time to apprise the engineer of the fact before the explosion occurred. A car in the train loaded with dynamite was badly damaged, but the contents did not explode.

15th, on New York Central & Hudson River, in the yard at the Grand Central Station, New York City, a new engine, which was higher than any of the others used on the road, struck an overhead bridge and the smokestack and dome were badly damaged.

16th, on the Burlington & Missouri River, near Akron, Col., car in a passenger train took fire in a vestibule and was slightly damaged.

A summary will be found in another column.

Punching and Shearing Machine.

The punching and shearing machine here shown cuts off bars of iron or steel 9 ft. long, cuts both ends at an angle of 45 degrees and punches a number of holes at the same time. It is 4 in. from centre of slide back to housings, and is so arranged that any length can be cut off, either straight or at any angle desired. The cross-bar carrying punches and shears is so designed that the strain is equally divided along the entire length.

The slides are fastened to the cross-bar in a manner that does away with all gibs and gib-screws, resting on the back against a straight, solid surface. The two pitmen are at their lower ends fitted into large sockets, the sockets being fastened to the cross-bar by strong screws. The shaft is 5½ diam. of steel and passes through both housings, having clutch and gear-wheel on one end and a number of holes or ports to receive a lever for moving by hand on the other.

The tight and loose pulleys are 30 in. by 8 in. face, running on a 2⅞-in. steel shaft, on which on one side a 750-lb. fly-wheel is attached, and on the other side a pinion driving the big gear. The stay rod on top is provided with nuts on each end, serving the purpose of adjusting slides nicely.

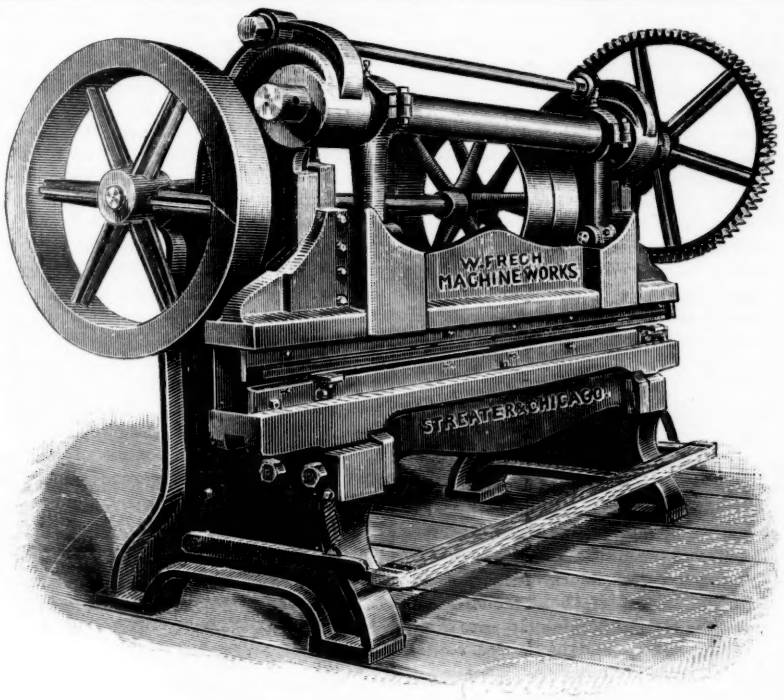
The punch bar, holding punches and upper shears as well as the die bar underneath, are detachable from the cross bars in order to admit more easily any number or shape of punches, dies or shears, and at such distances as suit the requirements. A pressure bar is also attached to the punch bar, which has a double mission. In the first place it straightens or holds the material down tight while punches and shears are passing through the material, and in the second place is acting as a stripper or take-off, leaving the die-bed free from obstructions and rendering it easy to take work out and in. The clutch is operated either by foot or hand, or both. The opening between housings is 6 ft., but the whole machine can be made shorter or longer as may be required, also the distance back from centre of punches can be increased. The machine will make from 15 to 20 strokes per minute, but can be easily speeded to suit the nature of the work.

This machine is made by the W. Frech Machine Works, Streator, Ill., 68 and 70 Monroe street, Chicago.

Foreign Railroad Notes.

The Prussian Minister of Public Works has issued instructions by which the use of locomotive whistles is to be somewhat limited so as to lessen the annoyance caused by the sound. It is ordered that the whistle shall never be sounded more times than the signal regulations prescribe. Tank engines, which take only a few cars, are to have small whistles with a mild tone; engines with the tender separate, used for passenger trains, are to have two whistles, one small with a mild tone and the other larger with a moderately loud voice; and the freight locomotives also will have two whistles, one small and the other large and with a deep voice (not necessarily a screamer, we suppose). The small whistles are to be used exclusively while switching; the large ones only for signals which must be heard at a considerable distance, say at the other end of a considerable train. The inhabitants of Stamford, Conn. (unless there has been a change within the last five years), will now probably favor the transfer of a certain railroad with whose whistles they are too familiar, to the Prussian State Railroad system. It might enable them to sleep nights.

The same authority is reported to have ordered that the open cars of the state railroads be modified so as to



PUNCHING AND SHEARING MACHINE.

The W. FRECH MACHINE WORKS, *Streator, Ill.*

have a capacity of 12,500 kilograms, instead of 10,000, as at present, an increase from 22,000 to 27,500 lbs., and that this be accomplished by the coming autumn. The proportion of open freight cars in Germany, and generally on the continent of Europe, seems to be not much greater than with us; it is only in England that the great bulk of merchandise freight is carried in such cars; but Prussia has a heavy coal traffic, and must possess tens of thousands of open cars, which it might seem difficult to run through the shops within five months. Very likely, however, not much more is needed to render them capable of carrying the additional load than to paint out the "10 T." on the side and put "12.5 T." in its place. If we are not mistaken, a good many American cars after 1878 had not simply 5,500 lbs., but 20,000 lbs. added to their "capacity," with no other tools than a paint brush, and we believe that not all of them broke down under the heavier load.

There is a strong demand for the provision of cars of still greater capacity in Prussia, and the same report says that this subject is still under consideration in the Ministry.

Another novelty on the Prussian State Railroads is the provision of cars for the transportation of sick travelers. One of these is kept at each of six of the chief railroad centres, and will be sent to any station where wanted. How they are fitted up we are not now informed, except that they have "beds and everything necessary for the transportation of the sick." For transportation in such a car you must buy 12 first class tickets, which amounts to about 42 cents per mile. They will probably find their chief use in the next war for the transportation of sick and wounded officers of high degree.

A railroad has been for some years in progress which will complete a line from Turin, southward, over the Maritime Alps to the Mediterranean at Ventimiglia, which is close to the French frontier. A contract has recently been let for one of the last sections, a little more than five miles long, in which distance there will be seven tunnels, the longest nearly a mile and a half (7,482 ft.) long, and forming a semi-circle; while one other will be 6,746 ft. long; also considerable bridges and viaducts. The work is to be completed in four years, at the same time with the great Tenda tunnel, which will be several miles long.

The Government Engineers warmly recommended the adoption of the Abt system for this section of the road, estimating that it could be adapted for this at a cost of about $720,000, against $1,965,600 as actually designed. Probably military reasons caused its rejection. The railroad will be generally parallel to the French frontier, and will make it possible to transfer quickly an army between the practicable passes north of the Maritime Alps and the approaches along the coast, and for this a very large number of locomotives would be needed, which can be drawn from other lines, if the road is of the ordinary kind.

Nothing could show better the advantages which Italy obtains from its so-called steam tramways (which are simply light railroads of various degrees of lightness and simplicity, but generally following the highways where convenient) than the fact that new ones are begun and built continually in various parts of the country, in spite of its extraordinary poverty and the general financial distress.

A contributor to the *Journal* of the German Railroad Union, discussing passenger rates, gives a table showing the actual weight of cars and train, seating capacity, and average number of passengers per train of an ordinary passenger train, and an express train on the Bavaria State Railroad, and of the so-called "Oriental express," which runs between Paris and Budapest, and once a week through to Constantinople. The Bavarian trains cannot differ much from other German trains.

The ordinary passenger train consists of locomotive, one baggage car, one service car, two passenger cars with first and second-class compartments, and eight third-class cars. Such a train weighs 198 tons, and has seats for 360 passengers, but on the average has only 82 seats, or 22·6 per cent. of its capacity occupied, giving a dead weight of 4,840 lbs. per passenger.

The express train, with a locomotive of the same weight, one baggage and one service car, has seven passenger cars, with first and second-class compartments, and with a water-closet between each two compartments. Such a train weighs 193½ tons, and has seats for 182 passengers. Only 18 per cent. of these seats are occupied on the average, making the average train-load only 32 passengers for an express train, so that there is a dead load of 12,100 lbs. per passenger.

This seems unfavorable enough, but the proportion of dead to paying load is still more striking on the Oriental express, which, beside the baggage and service car, consists of two sleeping cars and one restaurant car, similar to the American cars, which afford accommodations for only 40 passengers, while the train weighs 187 tons. The average number of passengers is about 18, and the dead weight per passenger, therefore, about 20,800 lbs.

A tabulation of the figures will make it easy to compare the different trains:

	Ordinary train.	Express.	Oriental express.
Total weight of train.....	198 tons.	193½ tons.	187 tons.
Weight of pass. cars in train.....	113 "	100 "	60½ "
No. seats in train.....	360	182	40
Weight of car per seat.. .	630 lbs.	1,100 lbs.	3,025 lbs.
" " train " " 1,100	"	2,134 "	9,350 "
Average No. passengers...	82	32	18
" per cent. of capacity	22.6	18	45
Weight hauled per pass....4,840 lbs.		12,100 lbs.	20,800 lbs.
Proportion of weight of pass. to weight of train...	1:30	1:58	1:126

The moral of this is not so much that accommodations which make a car heavy necessarily cost more than they bring in, but that passenger traffic can be conducted economically only in large train loads. As it is actually conducted, however, on most routes, in Europe at least, the people who ride first-class and pay the highest prices are almost certainly carried for much less than cost, and the third-class passengers practically pay for a large part of the accommodations which the first-class passengers enjoy.

The German Railroad Union every four years, offers prizes, amounting in the aggregate to 30,000 marks ($7,200) for important inventions and improvements in railroad appliances or practices. This year the prizes are offered for such inventions as shall have been introduced within the *eight* years previous to July 15, 1891. Three prizes are offered in each of two fields—a first prize of 7,500 marks ($1,800), a second prize of 3,000 marks ($720), and a third prize of 1,500 marks ($360). These field are, first, construction and mechanical appliances; second, rolling stock and its maintenance. In the third fields, administration, operation and railroad statistics a first prize of 3,000 marks ($720), and a second prize of 1,500 marks ($360), are offered.

The Executive Management of the Union suggests as problems which at this time deserve particular attention, the following:

1. A locomotive boiler which, without any important increase of weight, will be secure from explosion and at the same time will lessen the cost of maintenance.
2. Improvement in the construction of locomotives, and especially in valve gear, by which steam may be used more economically.
3. A plan for simplifying the accounts for foreign car service.
4. A practical and durable coupling hose for steam heating or continuous brakes not requiring the use of india rubber.
5. A practical and cheap freight car brake for switching service.

It is not intended to limit the prizes to the things suggested, but they are pointed out as matters in which the need of improvement is now strongly felt.

To be eligible for a prize the invention must have been practically used on some railroad of the German Railroad Union, and be recommended by that railroad for the prize.

In 1880, the Hungarian railroads formed a mutual insurance society to meet the cost of damage by fire and accidents. During the first three years the expenditures were 112,139 florins for insurance for which they would have paid to insurance companies, according to their former practice, 568,213 florins. Hereupon, the Austrian railroad joined with the Hungarian companies and formed an association for the whole Empire, which in seven years has given the Hungarian roads alone insurance for 661,164 florins, which the insurance companies would have charged 2,008,588 florins for. At the beginning of this year the association was divided into two, one for Austria and one for Hungary.

Mineral Lands Claimed by Pacific Railroads.

Nothing has yet been done by Congress toward carrying out the recommendation of the Secretary of the Interior in his last annual report for legislation concerning the mineral lands claimed by the land-grant railroads. The vast amounts at stake naturally have stimulated the great railroad corporations of the Pacific coast to bring all their influence against any congressional action not tending in the direction of their interest. It is really to their interest that Congress should take no action at all, for if the Supreme Court of the United States should sustain the decision of Judge Sawyer in the United States Circuit Court for California in December last, the Northern Central and Southern Pacific Roads could immediately take possession of mineral lands of almost incalculable value. The Northern Pacific particularly would secure a bonanza sufficient to make the mouth water. The Northern Pacific runs through 800 miles in the state of Montana, and one-half of this distance is through a region abounding in the richest deposits of gold, silver and copper. The company under its grant has laid claim to 2,300,000 acres of land, covering 4,000 discovered mining properties bearing gold, silver and copper, yet unpatented, and nearly 1,000 patented mines, which have long been in undisputed possession of private owners. It is said that in one mining district alone the products of the private mines claimed by the Northern Pacific Co. are producing an amount nearly equal to the entire receipts of the company. The act of Congress making these land grants to the railroad corporations reserved the mineral lands. The Northern Pacific and other companies claim that this reservation applied only to lands then known to be mineral, and this construction of the act has been sustained by the United States Circuit Court for California. It is the best legal opinion that this is the proper construction, and there seems to be little doubt that the Supreme Court will sustain the Circuit Court. The effect would be in the State of Montana alone to take valuable mines from perhaps three-fourths of the private owners who have been in possession for from ten to twenty years. The act making the grant was passed in 1864, and most of the mineral-producing lands have been since discovered. The Secretary of the Interior strongly recomended such provision as would at least secure the private owners in their possessions. If this was done it would still leave to the Northern Pacific Co. unpatented mineral lands believed to be worth millions. From accounts which come here public sentiment in Montana is very much stirred up, and the action or non-action of Congress is awaited with the most lively interest. The railroad corporations have powerful lobbies constantly on the spot and working with unceasing activity, while the citizens can only look to their own Senators and members to care for their interests.—*Washington Correspondence Baltimore Sun.*

The Channel Tunnel.

The latest project which we have seen for a railroad across the English Channel is one proposed by Mr. Bunau-Varilla, a French engineer, and described in a recent issue of *Le Géne Civil*. The objection to a tunnel is, on the part of the English, very decided, as our readers well know. This objection is based upon the insecurity against the passage of troops. A bridge has also been proposed, but that is objected to not only on account of the great cost, but because of the obstacles to navigation presented by the piers. In a sea so foggy and stormy as the British Channel this objection would probably be a very formidable one. Mr. Bunau-Varilla proposes to eliminate the bad features of both of these projects and combine their good ones. That is, he proposes to make a composite structure, part tunnel and part bridge. For the greater part of the distance he would have a tunnel, but at either end he would have it terminate in bridges, one end of each bridge on shore and the other end to meet the tunnel at some distance out. He suggests communication between the tunnel and the bridges either by vertical lifts or by inclined planes. By this construction the possibility of quickly destroying communication, by the destruction of the end of a bridge by artillery or otherwise, will remain, and the navigation of the channel will not be obstructed,

RAILROAD GAZETTE

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EDITORIAL ANNOUNCEMENTS.

Contributions.—*Subscribers and others will materially assist us in making our news accurate and complete if they will send us early information of events which take place under their observation, such as changes in railroad officers, organizations and changes of companies the letting, progress and completion of contracts for new works or important improvements of old ones, experiments in the construction of roads and machinery and in their management, particulars as to the business of railroads, and suggestions as to its improvement. Discussions of subjects pertaining to* ALL DEPARTMENTS *of railroad business by men practically acquainted with them are especially desired. Officers will oblige us by forwarding early copies of notices of meetings, elections, appointments, and especially annual reports, some notice of all of which will be published.*

Advertisements.—*We wish it distinctly understood that we will entertain no proposition to publish anything in this journal for pay,* EXCEPT IN THE ADVERTISING COLUMNS. *We give in our editorial columns* OUR OWN *opinions, and those only, and in our news columns present only such matter as we consider interesting, and important to our readers. Those who wish to recommend their inventions, machinery, supplies, financial schemes, etc., to our readers can do so fully in our advertising columns, but it is useless to ask us to recommend them editorially, either for money or in consideration of advertising patronage.*

The collision which happened last Friday night on the Bedford division of the Pennsylvania Railroad was of the kind that might have been prevented by the use of certain mechanical appliances not in general use; but it might also have been prevented with the appliances actually in use had the train men done their plain routine duty. A freight train broke in two at the top of a grade, and the rear part of it ran back and collided with a train following it. Two men were killed and three were severely injured. The men injured and one of those killed were asleep in the caboose. Had the train been equipped with the air brake the accident would not have happened. Perhaps the M. C. B. coupler alone would have prevented it. But we cannot blame the road for not having these appliances in use on all its freight equipment. That would be quite unreasonable to expect for some years to come. The responsibility then rests with the trainmen, who have already been punished. Whether or not the responsibility could justly be carried back to the officer who hired these men and disciplined them we cannot say. We have lately heard a division superintendent on the same system say that he feels personally responsible for every accident. Even when it is the direct fault of an employé this superintendent thinks that he should have known better than to hire or keep in service a subordinate who will be careless or disobedient. This is a high standard of duty and responsibility, but we know that it is not peculiar to the division superintendent whom we have mentioned. We often meet with men, particularly among the younger officers, who take the same view of their duty. The man who maintains such a standard ought to rise high in his profession if he is tough enough to stand the wear and tear of his active conscience.

The Railroad Telegraph Superintendents' Association is rapidly gaining ground among the various national organizations, which meet annually for the purpose of exchanging views regarding railroad practice. The moving of trains safely, swiftly and punctually is the underlying principle of railroad work, and the proper performance of this function involves the use of electricity. At the Niagara Falls meeting the development of the block signal was well summarized by Mr. Robert Stewart in his paper published last week (page 438). How to use block signals was taken up by Mr. Nichols. He dwelt upon the importance of uniformity in the rules governing the operation of these signals, the necessity for which must become more and more obvious with the extension of the system. Mr. Kinsman believed not only in establishing schedules for freight trains, but in sticking to them. In his attempt to reduce this principle to practice he has effected a decided reduction in train orders, which he believes will continue in the future, especially if connecting roads co-operate in the reform. The other subjects presented at the meeting, Increase of adhesion by the action of electricity, "Lighting at wrecks," "Correct time," etc., were intelligently discussed, and there appears to be no existing association before which they could have been more properly brought. We regret that we have to postpone full reports of some of the reports and discussions. The rapid growth in membership and the character of the proceedings is the natural result of earnest effort. At least one general manager insisted that his superintendent should attend, in spite of wash-outs and trouble on his lines; this shows that the work of the association is appreciated. Many telegraph superintendents and despatchers have heretofore risen to influential managing positions, and though somewhat higher qualifications are demanded year by year in the more responsible positions there is no good reason why many of these men should not be promoted. They have the "inside track" on electrical subjects, and each man should see that no other officer on his road gets ahead of him in this respect.

Charges on Food Products.

In the "Liberal" Convention of 1872, which nominated Horace Greeley for the Presidency, there was some difference of opinion on the subject of the tariff. It was finally settled by allowing the free-traders to make the platform, and the protectionists to name the candidate. Of a good deal the same sort is the plan adopted in the Report of the Interstate Commerce Commission on Grain Charges. It tries to suit the railroads with its platform and the farmers with its actual suggestions in regard to rates.

The railroad principle is to make rates to develop volume of business; and this the commission recognizes as being fundamentally right. Nor would it require the railroads to develop business as a duty, whether the traffic paid expenses or not. It makes short work of the claim that there is a natural right to have food carried to the consumer at rates low enough to leave the farmer a profit. "The rate of compensation which railroad companies may lawfully receive cannot be so limited that the shipper may in all cases realize actual cost of production." It shows in forcible fashion the absurdity of some of the current rhetoric.

"There is an excellent clay in Nebraska for making bricks, a useful and creditable industry. Bricks are much needed in New York. The people of Nebraska have a right to make them as well as a right to have them shipped to New York at reasonable rates. But it might be that when such reasonable rates were deducted from the price received the remainder would be less than the "actual cost of production." That would not necessarily make the rates unreasonable. Unfortunately it may be, but still of necessity, the claims of the shipper must wait upon the rights of those whose services he employs and whose property he uses. The employés who run the train may have neither brick, corn, nor railroad investment, but they must be paid for their services. The road must be repaired and bridges mended. Actual and honest investment must receive fair reward. All this must be paid before the profits or actual cost of producers are paid unless the services and property of others are to be appropriated to the use of those who for the time may be engaged in an unprofitable business or disadvantageously located industry."

The Commission believes, nevertheless, that existing rates west of the Mississippi are too high, because, on a ton-mile basis, they are so much larger than those of Eastern lines; and it proposes certain specific reductions, which, it is claimed, would be ruinous to many of the roads concerned. This claim is probably exaggerated in many of the interviews and reports, but it has a decided element of truth. But apart from the results in the particular case, the proposals of the Commission involve the abandonment of its own principle, which has proved good for the country as well as for the railroads, and the practical adoption of a much worse one in its place.

The principle of making rates to develop business, so as to secure the largest net return, has worked to the advantage of the shipper in two ways. It has allowed any region to have a railroad if the business could pay for it; and when the railroad was once built, it has encouraged the lowering of rates in those lines of business which most require it. It gives us more railroads and, on the whole, lower rates. The first point is obvious enough. The second sounds somewhat like a paradox, but it is no less true than the first. If a railroad is managed on good business principles, it secures the highest standard of economy and efficiency which we are likely to attain. The effort to have it managed on something better than business principles usually results in having it managed worse. If we try to insist that a railroad shall reduce its rates so as to divide profits with the shipper, we take away the incentive to efficiency. For the sake of a slight reduction at the moment, we destroy the chance of much greater reductions afterward. The improvements which are made as a means of handling larger volume of business do more to lower rates than could possibly be done by legislation. Take away the business motive for securing such volume by rendering the business unprofitable and you surely check the improvements and facilities. No man did so much toward lowering rates as Commodore Vanderbilt; and no man had less sympathy with the idea that railroads were to be run as charitable institutions. He treated them as business enterprises; and by so doing, he accomplished more for cheap transportation than all the theorists who are trying to decide upon fair rates which shall bear an equitable relative burden of the fixed charges.

Of course, we cannot carry this theory of business to an extreme. We cannot let the railroad agent make special rates for each individual shipper. We have to prohibit discrimination, because the company is so much stronger than any individual that vast injustice may be done to certain shippers without its being felt by the railroad as a whole. But there is no such need of prohibiting extortion. The shippers all put together are industrially more powerful than the railroad, rather than less so. A railroad which disregards the collective interests of the shippers will almost immediately suffer; first in volume of business, then by the construction of parallel roads which invade its territory, and force it to pursue a more liberal policy whether it will or no. As a matter of practical experience it has been found best to leave the general schedule of rates to regulate itself, and simply insist that whatever principles are chosen shall be applied equally, not treating one individual differently from another.

To the results of this system we now find the following objections repeatedly urged:

1. It causes rates for the same goods to be very much higher in one part of the country than another. This is the point most strongly brought out in the opinion of the Interstate Commerce Commission which we are now discussing.

2. The shippers in newer sections are burdened with the charge for supporting lines of parallel road built in advance of the actual needs of business.

3. The shippers are charged an unnecessary amount in order to pay dividends on watered stock and to cover liabilities on uprofitable sections of railroad or unwise lines of business in which the company has engaged.

These objections we answer as follows:

1. Of course the newer country has to pay the higher rates. The volume of traffic which it can furnish is so much smaller than that of an older country that nobody could build a railroad at all unless it could make up for the relatively small volume of traffic by charging more for each car-load. If the Commission proved that the traffic west of the Mississippi would increase enough to make up for this proposed reduction in rates, that would be another thing; but it does not seriously try to do so.

2. The claim that the volume of Western traffic would justify lower rates if it were not divided among several parallel lines, would have some force if the inhabitants of the region had discouraged the building of these lines. But such is notoriously not the case. The first road in a district certainly did not want competitors; but the inhabitants did, and got them, and cannot fairly complain of the results of their own action.

3. The objection concerning dividends on watered stock needs but brief notice. "My dear boy," said the minister, "don't you know that it's wrong to catch fish on Sunday?" The boy looked sadly at his basket and simply said, "Who's catchin' any fish?" The whole theory that a railroad man makes his rates high because he has high nominal capital, or large outside burdens, or unprofitable branch lines, has no relation to the facts. The roads with the lowest rates are quite generally those that are apparently worst off in these respects. The Baltimore & Ohio does not charge high rates on account of its branch lines, nor the Erie on account of its water. They must charge rates low enough to keep their lines profitably occupied with traffic, and they do, in fact, charge very low ones.

So much for the alleged reasons in favor of fixed reductions in rates. Now for an important reason against them which is too often overlooked. In the majority of instances they do not effect even the temporary relief which their advocates desire. If a railroad voluntarily makes a reduction in rates and thereby develops business, it proves that a slight difference in cost will increase the demand for the products of that section, so that the producers will get a large share of the benefit. But if the road is compelled to make a reduction which does not increase the volume of business, this fact itself generally shows that the demand does not respond to the change in cost. In the absence of such increased demand, the market price will tend to fall, and the producers, in the end, get little or no more than they did before. This has recently been the experience in Nebraska; and there is danger that it may be repeated on a larger scale if the Interstate Commerce Commission tries to imitate the Nebraska policy.

Abolition of Grade Crossings in Massachusetts.

The Massachusetts law providing for the abolition of highway grade crossings, referred to in our issue of June 13, has been signed by the Governor, and is now in force. As we then stated, the railroads must pay 65 per cent. of the total cost of changes, including land damages, etc., the towns not more than 10 per cent., and the state the balance; but the maximum amount which the state will spend annually for this purpose is $500,000 instead of a million as was at first proposed. The State will pay altogether not more than five million dollars. The passage of this law marks an important advance toward the solution of this very complicated problem. Massachusetts sustains her reputation as a progressive state, and in this, as in her other railroad laws, sets a model worthy to be widely copied, in principle if not in detail.

As our readers will remember, the special commission of civil engineers appointed in 1888 reported in 1889 that the construction of stone bridges in place of all the grade crossings in the state would cost $40,000,000. The present plan, therefore, seems to provide (by a rough estimate) for one half of this work, the gross amount promised by the state being 25 per cent. of twenty millions. While, however, the state is ready to pay $5,000,000 within 10 years, the question of spending thirteen milions in that time, which confronts the railroads, is a more serious matter. The companies reporting to the state paid in dividends last year seven and one-third millions, being 4.86 per cent. on the total capital stock. It will be seen that an expenditure of $1,300,000 yearly for grade crossings would be nearly one-fifth of this sum, and, of the dividends representing property within the limits of Massachusetts, it would be a much larger fraction.

But while the study of these gross amounts may not be specially instructive, the actual workings of the bill being likely to be affected by various local considerations tending to vitiate any calculations made on averages, the actual impetus to the changing of grades will no doubt be of marked importance, and the results which will now follow will be watched with interest. The new law was originally prepared and reported by Senator Coffin, of Boston, and has been exhaustively discussed in committee. The commission of 1888 did not recommend that the state pay any portion of the expense of making changes, but the present movement seems to have started out with the intention of charging about 25 per cent. to the state. To this was added an arbitrary stipulation that the roads pay 60 per cent. The railroads took part in the conferences of the committe of the Legislature and entered enthusiastically into the movement. The new law, even with arbitrary provisions, and even though the apportionments on this arbitrary basis should prove unduly burdensome to the roads, is undoubtedly preferable to the uncertainty and constant annoyance from appeals and other delays incident to the operation of the laws heretofore governing this matter, and the railroads were therefore finally prevailed upon to accept the impost of 65 per cent. instead of 60. We understand that the Boston & Albany, Old Colony, and Boston & Maine favored the bill as finally passed.

By the old system the roads had first to deal with the municipalities (after making elaborate estimates of the cost), and then submit to remonstrances from towns, counties and individuals. Appeals were taken to the courts and decisions, if arrived at at all, were as likely to be based on mere expediency as upon any rational rule. The most common method of adjustment has been for the railroad company to do all the work on its own premises and for the town or city to pay the land damages and change the highways outside the railroad location. Under this custom the percentage of total cost falling to the railroads has varied greatly. In a district remote from dwellings, where land damages are very low and the highways are narrow, the railroads have often paid much more than 65 per cent. In a city or large town where the payments to abuttors were heavy, and streets must be built in the most substantial fashion, the expense to the railroads, while absolutely heavy, has been smaller in proportion to the total cost of the change. We have been able to get statistics in but few instances, but those we have, being based on work done in large villages, may perhaps be regarded as representing a medium between the two extremes mentioned. The railroads in these cases bore about 75 per cent. of the total cost.

It seems probable, then that the railroads will at once make applications under the law for changing as many country crossings as they can afford the 65 per cent. for, and that large towns, if they are awake to the situation, will make similar applications for the more largely used crossings. As the Railroad Commissioners are charged with the duty of deciding which applications shall be accepted (when the probable burden upon the state for the total number of cases presented seems likely to exceed the limit of expenditure authorized for the current year), they will at once become the practical administrators of the act, so far as the distribution of the state's money is concerned. The high reputation of the Massachusetts Board affords ample warrant for the expectation that the law will be administered for the best interest of both the public and the railroads.

The Convention of the Master Mechanics' Association.

The conventions of the Master Car Builders' and the Master Mechanic's associations are over and any careful observer must conclude that the time spent at them by railroad officers was well spent, and that the knowledge gained and the work done by those in attendance will at least offset the time taken from their regular duties. It is unnecessary to dwell upon the advantages of these conventions. All that can be said has been said over and over again, but in passing we would call attention to the growing value of the "exhibits." It is worth any man's while to travel a good way to see such a display of devices and material as was made at Old Point Comfort this year. Of course some trash was shown, but the percentage of that part of the exhibit is getting smaller year by year. It is worth mentioning also that this year the "supply men" took a less conspicuous place in the social part of the conventions than they have taken in recent years. Their share in the year's conventions was essentially dignified and useful.

Perhaps the greatest present difficulty in the management of these conventions is to increase the attendance. This is especially true of the Master Mechanics' Association. A considerable number of railroad men who are members of both associations attended the Master Car-Builders' meeting, but would not remain for the Master Mechanics'. Some have the good reason that they cannot give up the time for both, and they believe that, because of the rules of interchange and of the general interchange of car equipment, the Car-Builders' Association needs first attention. Still other members do not like the methods of conducting business now followed by the Master Mechanics, and, instead of remaining to help, they go away and thus weaken the number of those who are trying to bring about reforms.

However, in spite of the absence of a considerable number of prominent members who attended the first meeting, but did not stay for the second, two steps were taken that may help matters. The most important was the appointment of a joint committee to confer as to a plan for bringing the conventions within one week. This will take away the excuse of those who have not time to attend both conventions under the present arrangements of meetings. The other step was a change in the manner of electing officers in the Master Mechanics' Association. This was introduced by the oldest officer of the Association, and one of the most respected. He has become convinced that a change in this respect is necessary to get at the true choice of the members. His remarks were very effective, and the resolution to vote without nominations by a committee was carried. Some of the officers this year were elected by this method, but the plan was defeated in other cases. It is hardly worth while to go into a discussion of this matter; doubtless the Association will settle it wisely.

There is a matter, however, which is worth immediate attention; that is, the action of the association in adopting standards. This was illustrated at Old Point Comfort in the case of the standard axle for heavy tenders. The committee presented a diagram of the M. C. B. axle for 60,000-lb. cars, with no dimensions given, and recommended its adoption as the M. M. standard for heavy tenders. The point was made that the Master Mechanics' Association is an independent body, and its standards should not be subject to changes by the Master Car Builders' Association, and it was decided to have dimensions put on the drawing before it was adopted as standard. A motion was made to vote on the matter by letter ballot, but it was lost because it was said that there was no provision for such ballot. The result is that an important standard is adopted by the Association on a vote of about 40 out of about 320 members. The 40 who voted knew the committee's recommendation but a few hours before voting and there was practically no chance for serious consideration of it. In this case the result arrived at is good, but the method of getting at it is pretty bad.

It goes without saying that it is desirable to have the same standards in the two associations so far as possible, and the fact that a form or dimension is standard with one association is in itself an argument for its adoption by the other. The action of the Master Mechanics' Association in this matter is therefore on its face commendable. But a standard adopted by the vote of one-eighth of the members has a slim chance of coming into use. The recommendations of the association can only have their proper weight when they are made with deliberation, and when every member has a chance to vote on them. This can only be secured by submitting them to letter ballot.

Much to the same end can be done by distributing the reports long enough before the conventions, and the action of both associations this year requires that the reports be in the hands of the secretaries by May 1, and sent out by June 1, in order that each member may be prepared with his discussion when he reaches the meeting. If, in addition to this, the speeches could be limited to 5 or 10 minutes, as in many other bodies, the advantage would be great. With time for preparation a man can get a great deal of argument into 10 minutes talk, and it seldom happens that a speech in these mechanical discussions would not gain point and force by condensation. Besides, there is involved a question of abstract right and wrong. A man is morally bound to give others a chance to talk, and to facilitate the dispatch of business by making his own argument as brief as he can. All of this can best be brought about by letting the members know what they are going to discuss some time before they get to the conventions.

May Accidents.

Our record of train accidents in May, given in this number, includes 68 collisions, 56 derailments and 5 other accidents, a total of 129 accidents, in which 65 persons were killed and 140 injured.

These accidents are classified as follows:

COLLISIONS:		
Rear	40	
Butting	19	
Crossing and miscellaneous	9	
		— 68
DERAILMENTS:		
Loose or spread rail	3	
Broken bridge	3	
Defective switch	4	
Broken axle	2	
Broken truck	1	
Broken brake beam	2	
Broken car	1	
Boiler explosion	1	
Misplaced switch	2	
Open draw	2	
Cattle on track	5	
Washout	3	
Landslide	2	
Sand drift	1	
Malicious obstruction	2	
Purposely misplaced switch	1	
Unexplained	21	
		— 56
OTHER ACCIDENTS:		
Boiler explosion	3	
Miscellaneous	2	
		— 5
Total number of accidents		129

The causes of collisions, where given, were as follows:

	Rear.	Butting.	Crossing and other.	Tot'l.
Trains breaking in two	5	..	..	5
Misplaced switch	7	2	..	9
Failure to give or observe signal	7	..	2	9
Mistake in giving or understanding orders	1	7	..	8
Miscellaneous	9	2	5	16
Unexplained	11	8	2	21
Total	40	19	9	68

A general classification shows:

	Collisions.	Derailments.	Other.	Total.	P. c.
Defects of road	..	10	..	10	8
Defects of equipment	5	7	3	15	12
Negligence in operating	42	4	2	48	37
Unforeseen obstructions	..	14	..	14	11
Unexplained	21	21	..	42	32
Total	68	56	5	129	100

The number of trains involved is as follows:

	Collisions.	Derailments.	Other.	Total.	P. c.
Passenger	24	17	1	42	22
Freight and other.	106	39	4	149	78
Total	130	55	5	191	100

The casualties may be divided as follows:

KILLED.	Collisions.	Derailments.	Other.	Total.
Employés	22	16	5	43
Passengers	3	16	..	19
Others	3	..	..	3
Total	28	32	5	65
INJURED.				
Employés	66	34	2	102
Passengers	31	5	..	36
Others	2	..	..	2
Total	99	39	2	140

The casualties to passengers and employés, when divided according to classes of causes, appear as follows:

	Pass. killed.	Pass. injured.	Emp. killed.	Emp. injured.
Defects of road	..	..	7	6
Defects of equipment	..	..	6	5
Negligence in operating	16	31	23	70
Unforeseen obstructions and maliciousness	..	4	1	13
Unexplained	3	1	6	8
Total	19	36	43	102

Thirty-three accidents caused the death of one or more persons each, and 43 caused injury but not death, leaving

53 (42 per cent. of the whole) which caused no personal injury worthy of record.

The comparison with May of previous years shows:

	1890.	1889.	1888.	1887.
Rear collisions	40	23	32	18
Butting "	19	18	27	17
Crossing and other collisions	9	4	4	..
Derailments	56	54	75	43
Other accidents	5	3	7	5
Total "	129	102	145	83
Employés killed	43	23	23	16
Others "	22	29	20	15
Employés injured	102	84	59	49
Others "	38	68	99	33
Passenger trains involved	42	36	57	30
Average per day:				
Accidents	4.16	3.29	4.68	2.68
Killed	2.10	1.68	1.40	1.00
Injured	4.52	1.90	5.09	2.35
Average per accident:				
Killed	0.504	0.510	0 296	0.373
Injured	1.085	1.490	1.089	0.879

The worst accident of the month was the drawbridge catastrophe at Oakland, Cal., which has been discussed heretofore. The engineer, Dunn, who jumped off the engine before it went into the water, was in Oakland for a day or two after the disaster and made some sort of statement to the officers of the road, but there seems to have been no action taken toward a legal investigation of his case, and, the last we heard, he had disappeared. There were two serious crossing collisions of passenger trains, one at Sheffield, Mo., the 23d, and one at Allentown, Pa., the 7th. The latter killed two passengers. The press dispatches attributed the causes of these to failure of air brakes, but we find that this was incorrect in both cases, insufficient brake power on some of the wheels, or rigging badly designed or maintained, combined with bad judgment on the part of the engineer, being the true cause in both cases. A third disastrous accident in which the non-use of air brakes played a part was that at Soldier's Summit, Utah, on the 26th. Three passengers were killed at Butte, Mont., on the 15th, but we have no particulars of the accident. The other accident involving the death of a passenger was the rear collision at Broadland, Ill., on the 16th. In this case it is stated that the pay-train was running 50 miles an hour. It will be seen that a man was killed by a collision of an officers' train with a work train in California. If very light trains which, practically, can be run at unlimited speed, are to continue as common as they are at present there is great need of revision of the method of protecting trains from rear collisions. It should be remembered that all our flagging rules were made on the assumption that following trains will not run much faster than the one which is to carry out the rule. As long as regular passenger trains are the fastest on a road, they enjoy immunity from rear collisions, from the simple fact that others cannot catch them, but just as soon as extras are allowed to "go as they please" in the matter of speed an added element of danger is brought in. The block system is demanded not alone on account of fast trains, *per se*, nor because trains are more numerous than formerly; but in addition to these reasons, because of greater or more numerous variations in the *rate* of speed as between different trains.

A butting collision near Chattanooga on the 12th resulted in the death of five trainmen. Another at South Lyme, Conn., on the 23d, was less fatal, but seems to have resulted from the continuance of an antiquated system. Dependence upon blowing a whistle as a preventive of butting collisions may have answered in 1840, but it is too much like boys' play in 1890. If trainmen can make meeting points as they please, regardless of the dispatcher, it would seem that there is great need on that road of a simple document called a train sheet.

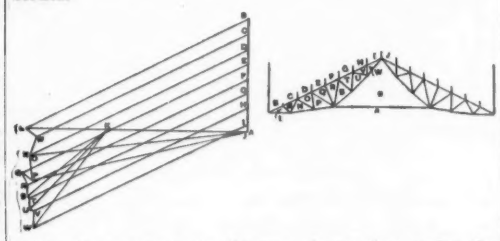
In four cases this month, viz., 3d, 24th, 28th, and 30th, parts of wrecked trains fouled the adjoining main tracks and derailed other trains. The collision at Richmond, Va., on the 28th was a dramatic affair, occurring as it did on the high bridge spanning the turbulent James River at that point. The daily papers which make a specialty of sensations had no trouble in filling a column about it.

There were four boiler explosions in May, three of them very bad ones. One of them will be found under the head of derailments, a large part of the train having been wrecked in consequence of the partial destruction of a bridge by the explosion. The boiler which exploded at Buffalo was carefully examined and no sign of any defect in the material or construction was found. It had been in use about 10 years and was thoroughly overhauled three months ago.

Near Jellico, Tenn., a hand car was struck by a freight train and four men upon it killed. In Wisconsin a hand car was thrown from the track by the breaking of a wheel and three men killed. At Houston, Tex., a couple of men riding for pleasure on a velocipede hand car were overtaken by a train and one of the men was kill d in trying to get the car off the track.

Rational Roof Trusses.

Don Joaquin Arájol, a Spanish engineer, in a work published at Barcelona, recently, presents a form of roof truss which he calls "rational." This word, however, does not convey the meaning of the idea implied, which is that the form requires less material than others, or that the type is the most economical. The following figures, which we borrow from *The Engineer*, show the arrangement of the truss and also a strain diagram under dead loads. From the centre of the rafter a normal strut $Q R$ is drawn whose length is equal to about one-tenth of the span. Then through its extremity, the abutment and the ridge joint, a parabola or circle is drawn and the bracing filled in as shown. The tie rod $A K$ finally connects the two lower joints at the ends of the normal struts.



The lower or strain diagram shows that under the action of dead load the stresses in the upper rafter $C M$, $D O$, $E Q$, etc., are nearly equal, and also those in the lower parabolic portion $A P$, $A N$, etc. The stresses in the webbing are small, so that practically all these members might be of the same size. The stresses in the tie $A K$ and in the upper parabolic portion $K S$, $K U$, etc., are also closely equal.

Sr. Arájol makes a comparison of the economy of the "rational" type with the common forms known as the "English" and the "French," both of which are extensively used in this country, and finds that the English truss requires about 15 per cent. and the French truss about five per cent. more material. These conclusions, however, are based upon the assumption that the rafters are of uniform section throughout, as is commonly the case in practice. But if each form be designed in strict accordance with theory, so that the sections are proportional to the stresses, the rational type has but a very small advantage over the others. It would appear, therefore, that the claim of Sr. Arájol in regard to the economic advantage of his new type is not one that is strongly supported.

The use of parabolic outlines in bridge trusses, in order to reduce stresses in the webbing, and to render those in the chords nearly equal, is of course well known. We do not remember that this has been previously advocated for the rafters of roof trusses, although curved or crescent roofs have been built with parabolic outlines extending over the whole span. But the same idea as that of Sr. Arájol was advocated for arched bridges as long ago as 1874 by Capt. James B. Eads, and an extended paper by him on the subject will be found in the "Transactions of the American Society of Civil Engineers" for that year. In the "upright arched bridge," as the type was called by Capt. Eads, there are two parabolas, one above and the other below the line joining the abutment with the peak, while the tie rod runs from one springing line to the other. It is plain that the full advantage of the parabola is thus more fully gained than by a single one with a straight rafter. Capt. Eads enunciated the strong thesis that "upright arched bridges can be more economically constructed than is possible by any other method whatever, no matter what length of span may be required." While this conclusion cannot be accepted, it is certain that in many special cases parabolic outlines have a theoretic advantage.

Some of the gentlemen assembled at Old Point Comfort to attend the conventions organized while there the Southwestern Railroad Club. The permanent headquarters of the club were not decided upon; a preliminary vote gave Atlanta 8, St. Louis 7, and Chattanooga 6. Those present at the first meeting represented nearly 20 different roads, and were well-known and prominent men. The officers elected were: E. S. Marshall, General Master Mechanic, St. Louis, Arkansas & Texas, *President*; William Garstang, Superintendent of Motive Power, Chesapeake & Ohio, *First Vice-President*; J. J. Casey, Superintendent of Motive Power, Louisville, New Orleans & Texas, *Second Vice-President*. The election of secretary and treasurer was postponed until the permanent headquarters could be decided upon. This is a step from which we may expect many good results, as the men who are initiating it are enterprising and enthusiastic. If we may be permitted to give a little advice we would suggest to the club that it would do well to take advantage of the experience and action of the Western Railway Club in the matter of publication of its proceedings. As is now well known, that club has recently adopted the policy of withholding its proceedings from publication until they can be revised by the members submitting papers and taking part in the discussions. The hurried publication of papers and discussions from stenographic reports, without revision by the speakers, is almost always unsatisfactory, and there is no good practical reason why time should not be taken to put the material in good shape before its final publication. The objection to this is the expense to the club of putting matter in type, and perhaps the Southwestern Railroad Club will not see its way to meet this expense. The Western Railroad Club is trying to do so by publishing advertisements in its pamphlet proceedings. This is still an experiment, and it is not certain that it will be found successful; but it is, at least, worth trying. Another difficulty which the new club will encounter will be to secure a large attendance at the meetings. No city which it can select for its headquarters is so great a centre for mechanical and operating officers as Chicago, and the members of the club will be so widely scattered that regular attendance on the part of many of them will be inconvenient, if not quite impracticable. The New England Railroad Club at Boston and the Central Railroad Club at Buffalo and the Northwestern Railroad Club at St. Paul all have a vigorous life and their meetings are well attended. Therefore, it is reasonable to suppose that the new club will have at least as much success as these clubs have had. On the other hand, the New York Railroad Club, with headquarters in the greatest city of the Continent, enjoys the peculiar distinction of being the least important and influential of all the railroad clubs of the country.

Disagreements between railroad companies and their trainmen have been numerous during the past two weeks, but the press reporters seem unable to get definite information about interruptions to traffic, and it is hard to get a clear idea whether passengers and shippers are much inconvenienced or not. The engineers of the Central of Georgia who objected to an inquisitive circular apparently succeeded in getting it withdrawn. The yard trainmen of all the roads centering in Cleveland, (500 men) suspended yard work for several days and the roads refused perishable freights for that city, but we do not gather that the movement of merchandise was entirely stopped. This strike caused a small strike at Pittsburgh, but the Cleveland men were all at work again on Monday of this week, and the Pittsburgh movement seems to have come to nought. At Cleveland the men in all the yards except that of the Cleveland & Pittsburgh got their pay put on an equality with the rates paid by the Lake Shore & Michigan Southern, and apparently secured about all the changes that they demanded with earnestness. The road brakemen on the Pittsburgh, Virginia & Charleston struck last week for the same wages as the Pennsylvania pays on other lines, which is from 10 to 20 per cent. advance over their present wages. All through freight trains were suspended for a day or two, but the men seem to have got a slight advance, and to have gone to work on Friday.

The trainmen on the Illinois Central struck on Monday at Chicago, because of the refusal of their demand for the dismissal of Superintendent Russell. The strikers uncoupled the passenger cars from the mail trains and offered to go out with the mail cars, but the road refused to allow the trains to go in that shape. As we go to press there seems to be a total suspension of business on the Illinois Central in Chicago, and the Michigan Central and Baltimore & Ohio, which use the Illinois Central tracks, are much inconvenienced. Men on other portions of the Illinois Central have made demands, and in one case stopped work for a few hours, but the dispatches about a general suspension of trains all over the system are apparently false. The grievance against Superintendent Russell is based on his retention in office of a trainmaster who is objectionable to the men.

At East St. Louis 500 freight handlers have struck for higher pay, and the Vandalia, Louisville & Nashville, Big Four, Ohio & Mississippi, Cairo Short Line, Chicago & Alton, Wabash, Illinois Central and Burlington have partially suspended work. The strikers demand an increase from $1.25 to $1.50 a day, and 18½ cents an hour for extra work.

We announced last week that the Eames Vacuum Brake Co. had entered its new pressure brake for the trials in South Australia. We are now authorized to state that the details of this brake are so far completed that the company will undertake to furnish an apparatus that will be interchangeable with the Westinghouse in operation, and in its main parts. It is not the avowed policy of the company to cut prices, but to keep up a high standard of material and workmanship.

The fine engravings of the largest crane in the world, which were published in these columns last week, were made by that enterprising journal the *American Machinist*. That the proper credit was not given at the time was not due to carelessness, but to a misunderstanding. In mentioning the matter now it is not amiss to speak of the uniform excellence of the mechanical illustrations which appear in that journal.

NEW PUBLICATIONS.

Proceedings of the Seventh Annual Convention of the Road masters' Association of America, held at Denver, September, 1889. John P. Ramsey, Secretary, Connorsville, Ind.

The meeting of this Association was reported at considerable length in the *Railroad Gazette* last September, and it is hardly necessary to give more space to this report than to merely mention its appearance. Some of our readers will have noticed that members of the Association complain that the report should appear eight months after the convention. Detroit was selected as the place for the next convention, which is to be held the second Tuesday in September.

Third Annual Report of the Board of Public Works, City of Duluth, Minn. Year ending Feb. 28, 1890.

This report gives a great deal of data of the municipal engineering of a city which has been growing with wonderful rapidity, and which has called into its service some high-class engineers. The volume includes a report on the extension of the sewerage system and on

paving for steep grades made by Mr. Rudolph Hering and Mr. Andrew Rosewater, consulting engineers. It contains also a report on, and plans for a 480-ft. drawbridge with iron trestle approaches, by Mr. A. P. Boller.

Journal of the Association of Engineering Societies, May, 1890.

This number of the Journal, which has just appeared, contains an Address on Retiring from the Presidency of the Western Society of Engineers, by E. L. Corthell; The Improvements of Railway Terminal Facilities as Related to the Transfer of Coarse Bulk Freight, by Edward Lindsley; Requirements of Specifications for Steel and Iron, by James Ritchie; Deflection of Framed Structures and Distribution of Stresses over Redundant Members, by Prof. J. B. Johnson, besides the proceedings of the Societies and the usual Index to Current Literature.

TRADE CATALOGUES

Illustrated Catalogue of the Fishkill Landing Machine Co., Fishkill on Hudson, N. Y.—This is a handsome catalogue, designed to show and describe the various styles of engines built by the company, and more particularly to call attention to the "economy, close regulation, and noiseless operation" of the improved Fishkill Corliss engine. This engine is described in considerable detail, with good diagrams of various special parts. Although the company illustrates no compound engines, it is prepared to build them in various styles, but it does not advise the use of a compound engine for manufacturing purposes where less than 200 h. p. is required.

Master Mechancis' Convention.

Continued from page 452.

THIRD DAY'S PROCEEDINGS.

Mr. MACKENZIE: It seems to me we are lumbering up this convention every year with more subjects than we can attend to. I move that it is the sense of this convention that not more that six subjects shall be handled at any one annual session.

Mr. BARR moved as an amendment that the number of subjects to be considered at the next meeting be left to the executive committee, which was agreed to.

On motion of Mr. Peck, "Brake Shoes" was added to the list of subjects.

On motion it was unanimously declared that the Master Car Builders' axle for cars of 60,000 lbs. capacity, with form No. 1 between the wheels, is of the proper dimensions and form for an axle for heavy tender.

STEAM PIPES, PASSAGES AND EXHAUST NOZZLES.

The committee on this subject reported that during the past two years the individual members of the committee have made a number of experiments with a view of finding some foundation to start from on which to determine the size of exhaust nozzles in proporion to other parts of the engine or boiler.

The conditions that must be fulfilled by a successful and desirable nozzle are: That it must create draft enough on the fire to make steam, and at the same time impose the least possible amount of work on the pistons in the shape of back pressure. It should be large enough to produce a nearly uniform blast without lifting or tearing the fire, and be economical in its use of fuel.

After two years of experiment and research your committee has come to the conclusion that, owing to the great diversity in the relative proportions of cylinders and boilers, together with the difference in the quality of fuel, any rule which does not recognize each and all of these factors would be utterly worthless.

The quality of fuel is one of the most important factors, and must be recognized. The diameter of the cylinder cannot be taken and the stroke and other proportions ignored. The size of stack alone, without taking into consideration the size of the cylinder, grate and flue area is manifestly at fault.

The principal question on which the exhaust nozzle practice of the country splits, is whether the pipe shall be double or single. Those using the double pipe claim that in this way only can the exhaust from one cylinder be prevented from adding injurious back pressure on the other, while the advocates of the single nozzle urge that the use of the exits requires that neither of them shall be central and consequently the exhaust will not produce the maximum effect, while the single exit, being in the axis of the stack, will produce the maximum effect, and can, in consequence, be made larger and reduce the necessary back pressure. Your committee regard neither of these opinions as correct without some qualification. We have found that there is very little difference in the back pressure in either plan, and this is entirely a question of design. So true is this that it is impossible to determine, from the card alone, which type of nozzle is used. Your committee is also of the opinion that the use of the single exit does not insure the concentricity of the exhaust steam with the stack, and that in very many of the single pipes the steam is not discharged even approximately central.

The greatest part of the experimenting of the committee has been with single pipes, with a view of embodying the results in future engines ordered by their roads. The questions which were to be determined were the total heights of the pipes and the height of the bridge, relatively to that of the pipe. Also the relation of the area of each exit at the meeting point to the final exit. The first of these questions we have not determined. Starting with the idea that, in order to reduce the effect of the exhaust of one cylinder upon the other, the bridge must be carried nearly to the top of the pipe, we have found that the height had no perceptible effect in this direction, but the greater the height relatively to that of the pipe, the greater was the difficulty in preventing the discharge from crossing in the stack.

Acting on this, your committee has in some instances reduced the height of the bridge to much less than half that of pipe, with no increase of back pressure. Your committee is of the opinion that the most vital point in the design is that the area of each of the two pipes—where they combine—shall in no case exceed that of the final exit, and the indications, so far, are that this area can, with advantage, be made decidedly less than the final one; how much less we do not know.

Your committee, are aware that in addition to the types of nozzle mentioned, there are various annular ones as well as those in which the discharge is spread after leaving the pipe, but as yet we have not been able to test their merits as compared with plain pipes, except in the case of the Smith triple expansion pipe on which experiments are now being made, and so far we have found that the pipe allows the engines to steam freely with a very large final opening, and we are in receipt of several communications from those using them in which a considerable fuel economy is reported.

Your committee would also state that the use of a large final exit relatively to that of piston does not of itself imply low back pressure. They have more than once been misled by making this assumption without checking it by the use of the indicator.

Your committee submits a drawing of one of the pipes which they consider has given good results, together with several cards from the engines using it. From these the members can judge how results compare with those obtained on their own roads.

In view of these facts, your committee feels itself incompetent to devise any plan to determine the size of the exhaust nozzle in proportion to any other part of the engine or boiler, and believes that the best possible practice is for each user of locomotives to adopt a nozzle that will make steam freely and fill the other condition named, best determined by an intelligent use of the indicator and a check on the fuel account.

Signed. A. W. GIBBS.
J. A. HILL.

Mr. A. W. GIBBS: The failure to make special recommendations was due to the great variation we found in practice. We find two very different patterns of pipes in use. In one form the steam is practically discharged into a receiver and then emerges. In the other form there is a continuous exhaust, prolonged from the time one cylinder exhausts until the other does. With some coals you can carry a very heavy fire to advantage, and in those cases the exhaust that produces the most pulsation produces the best results. With other coals it is necessary to use a very light fire.

Mr. GEORGE GIBBS: We determined for one particular nozzle that a certain vacuum produced certain results. We found that more than a certain amount of vacuum would pull the fire from the flues. But we were unable from that to draw a conclusion as to the size of nozzle for slightly different conditions.

Mr. GIBBS: We have 227 flues, 2 in. in diameter and 11 ft. long. We found that 8 in. of water pulled the fire through the flues badly, and at 5 in. it was about good vacuum for a running position. From that it varied all the way up to 12 in., when the steam was being worked with long cut-offs and at too high speed for that period of cut-off. Those were with double nozzle.

On motion it was agreed that the subject be continued and the committee enlarged.

BRICK ARCHES IN LOCOMOTIVE FIRE-BOXES.

The committee on this subject reported as follows: A circular was sent out and 31 replies received, showing that 24 roads used the arch, 14 of whom used circulating pipes, and 10 used studs, angle iron, or a combination of both to support it, and seven did not use use the brick arch in any form; three of the latter used anthracite coal for fuel, one used wood, one had tried the arch and discarded it; no reason given; the remaining two had never used it.

Actual tests, extending through long periods, show most conclusively that the brick arch may be used with a short front and diamond stack, with excellent results and great economy, when bituminous coal is used. But very few replies to our circular give positive data, from which even an average per cent. of the saving of fuel could be shown. Some of the replies say the saving is from 25 to 40 per cent. This assertion is backed by the unanimous opinion of all those using them. The same can be said of its efficiency in decreasing the number of live sparks thrown from the stack. We find no evidence that one well constructed and properly applied has any seriously damaging effect on the sheets of the fire-box or boiler tubes.

The average brick arch supported on circulating pipes costs about $30 in place in the fire-box. The addition of extension front averages about $100. The items of stack and cast front end proper, with door, are not included in the cost of the arch and extension as given here, as these would have to be used under any circumstances. The arch complete on circulating pipes is applied by some roads for from $17 to $20, while others who are equally as well equipped to do the work, say it costs them from $35 to $45. We also find the same difference in cost of applying extension front in various shops.

The information gathered by your committee shows conclusively that the first cost of the arch, supported on circular pipes in a safe and substantial manner, is about twice that of most of those supported by angle irons, protected studs, etc., and these latter devices, if properly protected by allowing the bricks to cover the supports, last longer than the best applications of the former, and the danger attending a bursting pipe is dispensed with. Those using circulating pipes for supporting the arch claim they are best, and say they have in most cases tried other plans and gone back to the pipes. Others who formerly used pipes have abandoned them for angle iron, and still others with studs protected by a pipe drilled to shield them, and the whole somewhat covered by the brick arch.

There are many points in favor of abandoning the circulating pipes if other satisfactory supports can be arranged. First, the circulating pipe support is attended with more danger from their liability to become clogged or burning thin and bursting, or from blowing out of sheets and scalding firemen or others, even where rigid inspection is made at regular periods. Second, the pipes are more costly to apply and difficult to adjust to position, and, in order to secure a safe and tight fit, great care must be taken in cutting and tapping holes and threading the pipe, sleeve, nut, etc, and in the few instances where arch pipes are put in and expanded in position, thinner tubes must be used and very large holes bored in the sheets opposite the ends of the tubes, all of which are somewhat objectionable. Third, the pipes are generally more or less in the way of working on the boiler tubes, particularly where more than three pipes are used, and if only three pipes are used, broken bricks cannot be utilized, which is one of the best features of the pipe support.

The good points of the pipe support are: First, as a rule, a simpler and consequently cheaper style of brick can be used. Second, if four pipes are used, nearly all broken bricks can be utilized, and to those familiar with the shipment of car load lots of ordinary arch bricks, this is a big item. Third, if, as claimed by many, the brick injures the side sheets when allowed to rest close and hard against it, the pipes will admit of a suitable space being left at the ends of the bricks without impairing the rigidity of their support. Fourth, when shops are well equipped and have a good system, the circulating pipe support can be put in for much less than it is costing most of our roads at present.

The cost of maintaining the brick arch and extension front is much less than the cost of keeping fire-tight and spark-proof any form of diamond stack. The comparatively gentle suction of the high nozzle of the extension is ample to clear the tubes and deposit the sparks in the front, but does not cut away the heavy steel wire netting below the nozzles. The sparks in the one instance are caught and driven before the exhaust steam and along with it, while in the other they are sucked or pulled after the successive exhausts, and the sand blast effect is destroyed.

In conclusion your committee find that the brick arch greatly assists in bringing about more perfect combustion . . and we, therefore, recommend its use for bituminous coal.

We recommend as the best manner of supporting the arch that method, known as the angle iron and stud supports, and we believe that the best features of some of these might be combined and worked into a support that will meet the requirements of the general service. We are not prepared to recommend the abolition of the circulating pipe, but we suggest the serious consideration of a safer and cheaper method for supporting brick arches than is obtained by their use.

We desire to call attention to the large number of arch bricks broken in transit and by handling after they are received. This is especially the case where bricks are hauled long distances and when shapes are flat, long and heavy. Some suitable means should be adopted to strengtben the brick by having iron rods made up in the moulds in such manner that should the bricks become cracked or broken through their section, they would be held together and could be utilized. As soon as exposed to heat in the furnace, they would fuse together from the effect of accumulated slag, etc.

T. W. GENTRY,
ALLEN COOKE,
L. C. NOBLE,
W. A. SMITH,
} Committee.

Mr. HICKEY: For circulating pipes we use a special brand of pipe, No. 11 wire gauge. It is 2 in. outside, the same size as the flue, so that we can caulk it and handle it as we would a flue; but the inside diameter is smaller on account of the increased thickness of gauge.

Mr. LEWIS: We had a number of engines on the New York, Chicago & St. Louis where the brick arches were supported on tubes running from the flue sheet to the back sheet in the firebox. The water on that division was very bad, and though we used a great deal of care in removing the plugs opposite the ends of those pipes, and ran the rod through there every time we washed the boiler, they would stop up, and the tendency was to draw out of the sheet and loosen themselves in the sheet.

Mr. MCCRUM: I use tubes to support the brick arch. The tube is expanded into each sheet with a wash plug opposite the tubes, and those are removed every time the boiler is washed out. In a year and a half we have had no tubes clog up.

Mr. MEEHAN.—We have used the brick arch eight years. We use No. 4 wire guage pipes. We made a thorough test when we commenced to use the brick-arch and extension, and we found positively that we had 30 per cent. saving. We number the pipes commencing at the right side. A record is kept, and they are taken out every 18 months. We have no trouble from the bursting of pipes.

Mr. MCCRUM: I recently made a change in an engine with 16½-in. cylinders that had a diamond stack with 2⅞-in. double exhaust nozzles. I took out a set of grates with an opening of 1⅛ in. between the fingers, and put in a grate with 1 in. opening. I put in a brick arch in place of the plain box, took the flues out and cleaned them. The front end was just 4 in. longer than the one that was taken off, making the front 36 in. from the flue sheet to the front door. I used a netting of No. 2½ wire (coarse). The engine's record for two months as against a previous year's record, by the same engineer and same fireman shows a saving of 43⅜ per cent.

Mr. HATSWELL: We can only make a general average saving of 10 or 15 per cent. on fuel on our road.

Mr. STEWART: The circulating pipe is a dangerous thing to engineers and firemen. We have used the brick arch for 20 years and never had a circulating pipe of any kind. We take a piece of 3 × ¾-in. flat iron and draw the end down so that we can cut a ⅝ thread on it; make a T-headed bolt and screw it into the side of the box, and rest the arch on that. We do not even let the head of the bolt into the brick. We set it on top of this lug, with a screw into the side of the box. We have no trouble with it. The heads of these bolts will last four to six years.

Mr. GENTRY: We have had pipes burst in service many times, and narrowly miss killing the engineer and fireman. We use almost the same plan as Mr. Meehan. Perhaps our pipe, 2 in. outside diameter, No. 4 wire gauge, is too thick. Thick pipe burns out very frequently, and we do not see how inspection will cover that dangerous point. We let a pipe run only about 18 months. If one pipe shows a defect others put in at the same time are taken out also.

Mr. BARNES: The Paris, Lyons & Mediterranean has built a locomotive boiler in which the barrel can be lengthened or shortened by rings. The tubes could be shortened to 9 ft. and lengthened to 23 ft. In the fire-box were placed three kinds of arches—a long fire brick arch, a short fire brick arch and a water arch. The water arch is known as the Tenbrink device. That boiler was put in a separate building and surrounded with every known piece of apparatus for measuring. With regard to the combustion and the evaporation per hour, it is found that the long arch always diminishes the evaporation per hour, but diminishes it less when the tubes are long. The short arch diminishes evaporation per hour for the long tubes and increases it for the short tubes. The Tenbrink, or water arch affects the total evaporation per hour as the short brick arch does, but more energetically. The long arch increases economy most when the tubes are short and when the vacuum is greater. The short arch operates in the same direction, but in a less degree. The Tenbrink or water arch produces the same effect as the long arch. With ordinary vacuums of $1\frac{7}{10}$ in. of water and for medium length of tubes the short arch increases economy six per cent., the long arch and the water arch about eight per cent.; the improvement reaches 9 and 12 per cent. for short tubes of 10.3 ft.

Mr. HICKEY: A pipe that is too thick expands and contracts so much that it is injured at the point of contact with the sheet. No. 10 or 11 wire gauge is more desirable than a greater thickness.

Mr. MEEHAN: We got different results from different classes of fire-box. A shallow fire-box did not give as good results as a deep one. I tried a No. 11 wire gauge, but I found when the thread was cut it made it very weak at the end, and it broke off on several occasions at that point; and I found it absolutely necessary to put in No. 4 wire gauge. You can readily see that you cannot afford to use a No. 11 wire gauge and use a nut.

PREVENTION OF CORROSION IN TANKS.

The report of the committee on this subject is condensed as follows: Mr. T. W. Gentry, Richmond & Danville, writes: We have greatly lessened the corrosion by keeping the iron scraped clean and regularly coated with very thick iron-clad paint. We require engine crews to take only enough coal on their in-bound trips to reach shops and have enough to fire up. This compels them to move all coal from top of tank, and exposes the sides and back of coal pit.

A reply from Mr. G. W. Rhodes and Mr. Wm. Forsyth, of the Chicago, Burlington & Quincy, reads as follows:

"The most important thing in preventing corrosion is to provide good drainage for all portions of the tank—at the top, sides and bottom—so that water mixed with sulphurous coal is not allowed to stand any length of time against the sheets. For this reason we make a space of one-half inch between the floor boards, and are careful to use no moulding around the rivets at the bottom of the water leg and outside sheet. We have made the top plates incline about 4 in. on the sides, and also a portion of the back top plates. The flat portion at the back of the manhole we expect to drain with a 2-in. pipe extending through both top and bottom of the tank. The inclined sheets add very little to the cost."

Mr. James Meehan, of the Cincinnati, New Orleans & Texas Pacific, writes as follows:

"We cut the flare from the rear part of the tank about 6 in. in front of the water hole, and run a flare across the tank in front, leaving the rear part of the tank with nothing but the hand railing. While the flare was around the tank and in the rear of the water hole, the water was caught on the top sheet, and passed through the fuel, causing the coal to freeze in cold weather and the tenoning of the tank frame to rot very rapidly, as well as corroding the tank."

Mr. James M. Boon (West Shore): The best way to prevent corroding would be to have the sheets galvanized. Some time ago he built a number of new tanks, the sheets of which, forming the coal pit and the top of tanks, were galvanized steel. He watched them closely, and while he remained on that road they fully came up to his expectation.

Mr. E. B. Wall: The flooring of tenders should be of yellow pine, thoroughly saturated in fernoline, with ¾ in. spaces between planks. We have found that oak floors help corrosion, as oak contains an acid which is very severe. The flooring in the coal space should not be elevated above the rest, but a quarter-inch plate of steel or iron should be used, and a space

allowed between the edge of the plate and the sides of coal space. The moulding around the bottom of the tank on the outside should not be used, as it prevents the escape of water. To prevent the corrosion of the top of the sheets in the tanks, on each side of the tank an overflow pipe should be placed.

Mr. H. Schlacks, of the Illinois Central, describes a method of arranging the water or manhole on the back of the tank for engines used in suburban service, which consists of a cast iron elbow riveted to the back of the tank, and states that this method prevents to a large extent the trouble of corrosion.

Mr. C. W. Rickard, Division Master Mechanic of the Nitrate Railway Company, located in Chili, South America, writes that, for inside of the water tank, with water containing several corrosive ingredients, a wash of pure Roman cement put on the same as whitewash, is used by him with good results. The committee, in conclusion, says that several coats of a superior metallic paint, allowed to become thoroughly dry and hardened before the tank is put to use, would prevent a great deal of this corrosion. Sloping the top sheets of the tank toward the centre of the coal pit prevents the standing of water on those sheets; but the fact remains that the moistened coal mixing with the cinders from the smoke stack, will cause a certain amount of corrosion

One member of this Association suggests that the side sheets of the coal pit be constructed of corrugated brass, the corrugation to stiffen the sheets, making it possible to use a lighter gauge. The high first cost would be an objection to this. A large amount of corrosion could be prevented by the men running the engines. It is the practice on some of the railroads to completely drench the coal with water, in order to lay the dust. When this is found necessary, water should be used with moderation.

W. J. ROBERTSON,
ALBERT GRIGGS,
O. STEWART,
JEROME WHEELOCK. } Committee.

FIRE BOXES ABOVE FRAMES.

The committee on this subject reported in substance as follows:

In answer to questions, 17 persons expressed themselves in favor of placing the fire box above the frames, principally to gain the 18 to 20 per cent. additional grate area. The greatest distance recommended from bottom of mud rings to the bottom row of tubes varied from 42 in. for soft coal to 16 in. for anthracite. The average was 22 in. Five members drop the mud ring at the front end, and 11 make theirs straight or level. Fourteen report single riveted mud rings, one double riveted, and two double riveted at the corners only. The mud ring is dropped in the middle at the front end between frames by three members, while 12 make them straight across or level. The depth of fire boxes recommended varies from 60 in. down to 42 in. at back end and 48 in. at front end, which is nearest to the average. Fourteen have had no trouble from flues (which are all 2 in. in diameter) stopping up, with furnace above frames, and four have had. In all of the latter instances the distance from the bottom of the mud ring to the bottom row of tubes was less than 20 in. Cast iron grates are used by fourteen members, mostly for bituminous coal, while four use water bars for anthracite coal. Brick arches are used by seven, with bituminous coal principally, and ten do not use them.

The idea of lengthening out a fire box beyond certain limits in order to secure a larger grate area is objectionable, unless a brick arch in the furnace be used to deflect the gases backward, so as to better utilize all of the heating surface of the crown sheet. Without such an arch, the gases, in rising from the surface of the fire, are compelled to assume the form of an hour glass in order to squeeze through the tubes. We are fully convinced, therefore, that it is better to place the fire box on top of the frames, and gain the desired grate surface by increased width rather than by length. This style of furnace is being received more favorably every day, and the prejudices that used to appear against it are not heard so frequently. Some of the more conservative of our railroad officials have adopted this method of attaining the desired object. The depth of furnace at the front end is an essential matter, and we find that where the distance from the top of the grates is less than 20 in., the lower tubes are invariably stopped up by fuel being drawn into them; and we have seen fire banked up in such a fire box so as to cover five or six rows of tubes. We advocate not less than 20 in., and more when it can possibly be had. The argument against the wide fire box, that it necessitates the hanging of the engine from the bottom, has no weight, because it is well known that an engine hung from the under side of the driving boxes rides very much easier than one with the springs on the top of the frame; beside, the springs and equalizers are more easily handled than when hung from the top. It is well known that raising the boiler so slightly as is required, does no harm, but is rather a benefit. It is urged that with the fire box above the frame the mud ring cannot be caulked. If the mud ring is properly put in there will be no need of caulking. The mud ring should be made thick at the corners, so as to put in a double row of rivets. No leaks have as yet occurred with mud rings thus applied.

With the fire box above the frames the combustion is very much better than when between the frames; and larger nozzles may be used, thereby lessening the back pressure. Cheaper fuel may be used, other things being equal. More water space around the fire box may be had, and the sides of the furnace may be inclined sufficiently to take advantage not only of the greater efficiency of the heating surface, but giving the water a better chance to circulate. We also have more space for the ash pan, and can hang it higher to keep it out of the snow and away from the driving boxes. The rigid wheel base can be shortened. It gives better clearance for eccentrics and straps. It makes a better-proportioned boiler, when found necessary to increase the diameter of boiler shell or to lengthen the fire box. The fireman can work his fire to better advantage, and the weight of engine can be more evenly distributed upon the wheels. The cost of keeping up the expansion braces is very much less, and the frames can be taken down and replaced at a very much less expense of time and money than with the furnace between the frames. Soft coal as well as anthracite is now being used in fire boxes above the frames.

We recommend double riveting at the corners of fire boxes, and that cast iron grates be used in preference to water bars. There will probably be put to work within the next few months at least 300 to 400 locimotives with fire boxes above the frames, from which reliable data can be taken.

FRED. B. GRIFFITH,
JAS. MACBETH,
W. A. FOSTER,
LEWIS F. LYNE. } Committee.

EFFICIENCY OF THE LINK AS COMPARED WITH OTHER VALVE MOTIONS.

The committee appointed to investigate this subject reported as follows:

Mr. David Clark, of the Lehigh Valley, writes as follows:

"We have three passenger engines running with link motion for main valve and independent cut-off combined. My object in combining the cut-off with the link is to increase expansion and reduce compression when cutting off earlier than half stroke. I also get less lap to the main valve, starting train quicker, especially on heavy grades, by the use of the link and independent cut-off combined. The compression is regulated by the link and the expansion by the cut-off. When the cut-off is out of gear and riding on the back of the main valve, it does not interfere with the link motion. The engine can be run with the link the same as without the cut-off applied. This gives two valve motions on the same engine. With the cut-off and link combined, the evaporation was found to be 15 per cent. less than with the link. A part of this saving may be due to short lap of main valve, which is ¾ in. on either end. I think it could be applied for $300. The engines have been running three years, and have demanded no extra expense. The main valve does not require frequent facing on account of traveling nearly full throw when the cut-off is used. With the link and cut-off the back pressure or compression is regulated by the reverse lever, and the cut-off and expansion with cut-off lever, thereby using just the amount of steam required as the load varies and sufficient compression to balance the engine at different speeds. With stations close together I do not think it is of much advantage, but on long runs I would apply it to all engines, freight and passenger."

Mr. Meehan, of the Cincinnati, New Orleans & Texas Pacific, says:

"All our heavy passenger engines are equipped with the link motion, with ⅞ in. lap., 1-32 in. lead, Allen-Richardson valve, steam ports 1¼×16 in., exhaust ports, 2½×16 in. We have an engine built by the Rhode Island Locomotive Works which deviates from this practice, the travel of the valve being 6¼ in. I am satisfied that for engines of this class, the Rhode Island plan is the best."

Mr. T. W. Gentry had found the Joy valve gear unsuccessful on several engines. He attributed the failure mainly to the great difference in the spread of the centres of cylinders in American locomotives as compared with English inside cylinder engines, for which the Joy gear had been designed. We also found that the large amount of vibration necessary to be provided for in our practice to meet the great difference in permanant way and irregularities of our track hindered proper adjustment.

"We have had some experience with the Waalschaert valve gear, and after a fair trial we could see no advantage over the ordinary link. It is fully as expensive and is more difficult of adjustment and more affected by wear."

Mr. Quackenbush, of the Chicago & Alton, furnishes blue prints of the Wilson valve motion as applied to C. & A. engines 43 and 88; engine 88 having ordinary D valves, and the 43 two valves on each side, one controlling the admission and cut-off, the other the exhaust. Also indicator cards from double valved engine No. 43, while in regular service.

Mr. H. J. Small, of the Southern Pacific, says: "We have 60 locomotives equipped with the Stevens valve motion. The cost of fitting up new and applying the Stevens valve motion to a locomotive is 25 per cent. in excess of the cost of the ordinary link motion with single slide valve.

"Its maintenance is largely in excess of the ordinary link motion, and its general effect is to increase the total cost of repairs.

"The very rapid admission of steam to the cylinders results in severe shocks and strains to the driving boxes, frames and rods. Much difficulty is experienced in keeping the valves properly adjusted, owing to the greater number of wearing parts and resultant loss of lead opening of valves

"A comparison of performance of eight 18 × 30 ten-wheel engines with Stevens valve motion with an equal number of 18 × 24 ten-wheel engines with ordinary link motion during the year 1889, on same division, as taken from the performance sheets, shows the following results:

"The Stevens engines ran 281,144 miles, 99 per cent. being in passenger service. The link motion engines ran 206,598 miles, 56 per cent. being in freight service.

"The Stevens engines show a decrease of 18 per cent. in consumption of fuel, and an increase of 41 per cent. in cost of repairs. Taking the cost per engine mile for fuel at 23 cents, we have a gain of 4.14 cents per mile in favor of the Stevens engines. Assuming cost per mile for engine repairs at six cents, we have a gain of 2.46 cents in favor of the link motion engines, and a final net gain of 1.68 cents per mile run in favor of the Stevens valve motion. . . . The Stevens valve motion would be economical only where the cost of fuel is greatly in excess of other items of locomotive expense, as is the case on this coast."

Mr. Ellis, of the Chicago, St. Paul, Minneapolis & Omaha, writes as follows:

"We equipped an engine with the Woolf valve gear in May, 1889. It is an eight-wheel passenger engine with 61-in. drivers and 18 × 24 in. cylinders. The valves have ⅞-in. outside and 1-32 inside the lap. The steam ports are 1¼ × 15 in., and the exhaust ports are 2¾ ×15 in. The exhaust nozzle is double, 3 7-16 in in diameter.

"This gear gives an alternating fast and slow motion to the valves, and thus secures a quick steam port opening and a prompt, clean release, with a proportionately short valve travel. On this engine when working at full stroke the extreme valve travel is 4½ in., and the lead is virtually constant. The link-motion engine making alternate trips with this one is otherwise of exactly the same pattern in every respect, and has an exceptionally good record, outranking any other in the service; but the Woolf gear engine has clearly shown its superiority in handling heavy trains at high speed, and at the same time uses less fuel. We have made no formal test, but there has been a marked saving. The engine is able to pass one of the four water stations without stopping.

In conclusion, your committee are of the opinion that there is no valve motion more efficient for general utility than a well designed link with large bearing surfaces—assisted in its work by steam passages and pipes of generous dimensions—free from sharp turns and bends—giving the link plenty of hot steam to distribute, and, most important of all, not crippled at the very end by a contracted exhaust nozzle.

JAMES M. BOON,
DAVID CLARK,
H. TANDY,
JOHN A. COLEMAN. } Committee.

The committee on subjects for discussion in 1891 reported as follows:

The selection of subjects for investigation has not at all times received from the Association the attention that so vital a part of the proceedings is entitled to. The Association should not only select subjects with extreme care, but the number of subjects that can be handled to advantage should also be decided.

1. Washing locomotive boilers. Methods in use causing the least delay. Effect on the plates of the fire-box while they are still hot from the brick arch. Situation of washout plugs. Describe the plan for washing out with hot water.

2. Best material for locomotive crank pins, and the proportions for same, suitable for engines having cylinders 17, 18, 19 and 20 in. in diameter.

3. Comparative advantages of operating locomotives with different crews on the "first in and first out plan," and that of confining men to certain engines, the latter not running a greater number of miles than can be performed by their regular crews. Discuss any improvements in the method of running engines.

4. Examination of engineers and firemen in their duties relating to the use of fuel, care of a locomotive, and ability to meet disorder or disability of machinery. To what extent it is practiced, and the best plan of conducting the same.

5. Locomotive rods, connecting and parallel. Suitable material for and the best form of. Relative merits of solid ends, and those constructed with straps, bolts and keys.

6. Office dials, most convenient for showing the condition, location, repairs required, etc., of all engines.

7. Relative economy and safety of using eight-wheel, ten-wheel, and mogul locomotives for freight and passenger service. This committee should be authorized to interview members, and it should be the duty of all members so required by the committee to appear before them and answer such questions as may be asked, such questions and answers to form an appendix to the report of the committee.

8. Best form of brake shoes for locomotive and tender brakes, with a view to finding out the wear of flanges on wheels and the increase of mileage between turnings.

P. H. PECK.
O. STEWART.

The Auditing Committee reported that they had examined the accounts of the Secretary and Treasurer, and found them correct. Resolutions of thanks for courtesies and entertainment were reported by the committee on resolutions and adopted. On motion of Mr. Hickey a resolution of thanks to the committee on compound locomotives was adopted. The election of officers was next proceeded with.

Mr. John Mackenzie was elected President; Mr. John Hickey, First Vice-President; Mr. W. Garstang, Second Vice-President; Mr. O. Stewart, Treasurer; Mr. Angus Sinclair, Secretary.

On motion of Mr. Short, it was resolved that chairmen of committees be required to send their reports to the Secretary not later than May 1, and that the Secretary be instructed to have the reports printed and sent to members in time to be read before the convention meets.

A ballot on the next place of meeting resulted in Montreal receiving five votes; Buffalo, one, and Cape May, 38.

The Secretary was instructed to go to the place that should be selected as the place of meeting some time before the convention, and reserve a sufficient number of rooms to accommodate the members of the Association.

The Kelsey Audible Signal.

We show herewith front and side elevations of Kelsey's distant signal, with an automatic gong attachment. The illustrations show the signal at danger and the gong *E* free to vibrate when the hammer is actuated by the passing of wheels over track instrument *K*. Wheels, in passing over this track instrument, raise the opposite end of the lever and with it the perpendicular rod *C*. When this rod falls back the projection *T* comes in contact with gong hammer *Q* and rings the gong. When the semaphore blade *B* is pulled down (to safety), as shown in dotted lines, it raises rod *I*, and the gong hammer lever *D*, being fulcrumed to rod *I*, is carried to the position shown in dotted lines. This carries gong hammer *Q* out of the path of projection *T* on perpendicular rod *C*. Wheels passing on and off will then raise and lower track instrument *K* and rod *C*, but will not move gong hammer *Q*. Gong hammer *Q* is held in its safety position by a weight on lever *D*, which is heavier than the hammer. The cam slot *F* is provided, in case the movement of the signal should be changed from 45 degrees to 60. After gong hammer *Q* has been raised to dotted lines by gong hammer lever *D*, rod *I* can keep traveling and yet not cause any strain on lever *D*, as cam slot *E* will travel over pin *W*. The automatic gong attachment can be applied to any distant signal, whether it be worked by a single or a double line of wire. If the distant signal is not farther than 5 ft. 6 in. from track the gong attachment can be placed on the same post; if farther away, a separate post is set up. In an application recently made by the company the track instrument is connected to a lever 50 ft. long, which lies parallel to the rail, like a detector-bar, and which serves to keep the track instrument continuously depressed during the passage of a train. By this means only one stroke is made for each train, the wheels of the second truck of a car coming in contact with the longitudinal lever, and holding it down, before the pressure from the first track has been removed. This gong has been in use on the Air Line Division of the New York, New Haven & Hartford in connection with the Kelsey drawbridge signal for the past three years, and has given excellent satisfaction. This signal is manufactured by the Kelsey Railroad Signal Co., of Florence, Mass., from whom further information may be obtained.

TECHNICAL.

Manufacturing and Business.

The turnbuckle department of the Central Iron & Steel Co., of Brazil, Ind., is running night and day to supply the large demand for its patent wrought iron turnbuckles. The company has been obliged to put in additional machinery in order to supply the demand for the article. A number of new sizes have been recently made.

The Robinson-Rea Manufacturing Co., of Pittsburgh, has shipped a large engine to the Pittsburgh Steel Casting Co. for its new Bessemer plant. Two 84-in. blowing engines to the Roanoke Iron Co., and a 110-in. knife shear to Moorhead-McCleane Co. for cutting 1½ in. steel plate. The addition to the foundry is nearly completed and a heat will be run in a few days.

Albert H. Porter, of Niagara Falls, N. Y., Engineer of the Cataract Construction Co., will receive proposals until July 19 for the construction of an 8,000-ft. tunnel, with cross sections of about 18 × 21 ft., for the Niagara Falls Power Co., at Niagara Falls.

Sealed proposals will be received by the Colt Land Co., No. 148 Ellison street, Paterson, N. J., until July 10, for the removal of Colt's Hill, in the city of Paterson. The hill contains about 275,000 cu. yds. of sand. Specifications can be seen at the office of Hilton & Menger, engineers, No. 309 Main street, Paterson, N. J.

The contract for the new stock house for the Isabella Furnace, at Barneston, Pa., will be of iron designed and built by the Berlin Iron Bridge Co., of East Berlin, Conn. The building will be 54 × 100 ft., and so arranged that loaded trains can pass entirely through the building.

Zürich, in Switzerland, is to have an electric railroad on the Thomson-Houston system, and water power from the small river Limmat is to be used in the power station. The road is to be about two miles long.

The Lane & Bodley Co., of Cincinnati, this week closed contracts with the Cincinnati Street Railway Co. for two 28 × 60 and one 24 × 60 Corliss engines. The firm has also sold a 22 × 48 engine to the Henry Pearce's Sons' Cotton Works, and an 18 × 42 to the Walworth Electric Light Co., of Boston, Mass.; also 20 × 48 Corliss engine for the Main Street Electric Railway Co., Cincinnati, Ohio, operated by the Cincinnati Incline Plane Co.

Iron and Steel.

Riter & Conley, of Pittsburgh, have received the contract from the Tonawanda Iron & Steel Co., of Tonawanda, N. Y., for the erection of a new furnace 17 × 75 ft., and for three hot blast stoves.

The Northwestern Malleable Iron Co., of Milwaukee, Wis., has built a new foundry, 70 × 150 ft., and equipped it with two reverberatory melting furnaces. This addition increases the company's capacity to about 6,000 tons of castings per annum.

James McGill & Co., Limited, of Pittsburgh, have a large amount of hydraulic work on hand in the way of cranes, etc., which have been ordered by the Allegheny

Bessemer Steel Co., and by firms in Latrobe, Pa., and Montreal.

The South Tredegar Rolling Mill, of Chattanooga, Tenn., has about completed its bolt and nut making equipment.

William Tod & Co., of Youngstown, O., are building for the Pe nsylvania Rolled Steel Wheel Co., of Norristown, Pa., a pair of blooming mill engines, duplicates of those built recently for the Chester Rolling Mill Co. The same firm has under contract engines for the Latrobe Steel Works, Latrobe, Pa.; Anniston Rolling Mill Co., Anniston, Ala.; Pennsylvania Steel Co., Steelton, Pa., and the Youngstown Electric Light Co., Youngstown, O.

The Pennsylvania Rolled Steel Car Wheel Co., of Norristown, Pa., which manufactures steel and steel wheels under patents controlled by the Continental Rolled Steel Car Wheel Co., has merged with the latter into a new organization to be known as the Norristown Steel Co. The capital stock of the new concern is $200,000. Shares will be issued and given in exchange for shares of the Continental and Pennsylvania on the basis of the amounts paid in. The capital stock of the Continental Co. was $100,000, at $50 per share, for one-half of which inactive stock in the same company will be issued share for share. The capital stock of the Pennsylvania Co. was $1,000,0000, one-half of the shares being issued to the Continental for the privilege of operating under its patents. On the other half 20 per cent., or $10 per share, was paid in. The directors have elected S. D. Hawley, President; Joseph M. Cranston, of Philadelphia, Treasurer, and J. Clinton Sellers, Secretary. The plant near Norristown, on which work was commenced some time ago by the Pennsylvania Co. is well under way, so far as the masonry is concerned, and the boilers will be placed in position in a few days.

The American Bridge Co., of Roanoke, has ordered much new machinery. An addition is being made to the foundry building, and arrangements have been completed for the construction of an additional building 75 × 100 ft. in dimensions. The company has 150 men at work on the 150-ton furnace being built at Pulaski City for George T. Mills.

The Rail Market.

Steel Rails.—The following quotations are given: New York, $31@$31.50, summer delivery; Chicago, $34@$34, and Pittsburgh, $31.50@$32.50.

Old Rails.—The eastern market is active, and sales have been made at about $24.50 ex-ship for foreign, and $25 for double heads. At Pittsburgh old iron rails sell at $26.50@$27, and steel rails $21@$21.50. The Chicago prices are $25.85@$26 for old iron rails, and $21 for long steel rails.

Ries' Electric Traction Increaser.

One of the exhibits at the Master Mechanics' Convention was that of the Ries Electric Traction and Brake Co., represented at the meeting by Mr. Elias E. Ries, of Baltimore. This exhibit consisted of a small model of a locomotive running on a short length of track, one end of which could be raised to various grades. Under ordinary conditions the locomotive slipped and could not mount the incline when the track was elevated to a 20 per cent. grade. On passing a low-tension electric current between the driving wheels and rails, however, it ascended this grade without slipping, and repeated this performance on a grade of 40 ft. in 100. The same principle is applied to assist the brakes in stopping a train on down grades. The locomotive was permitted to slide about half-way down a 25 per cent. grade, and on closing the traction circuit at this point its downward course was almost instantly arrested, and it promptly proceeded to reascend the grade. It is claimed that the tractive adhesion of locomotive driving wheels can by this means be increased fully 25 per cent., and that the electric current is less objectionable and cheaper than the use of sand. We did not learn, however, that any of the master mechanics present changed their views as to the usefulness of this device; also it is not shown whether the adhesion gained bears any direct proportion to the weight on the wheels. It may be that as much total increase of adhesion is obtained with the electric current in the case of the model as would be found if the device was applied to a 50-ton engine; if so, then the increase of hauling power would be less than one per cent.

Smith's Triple Exhaust.

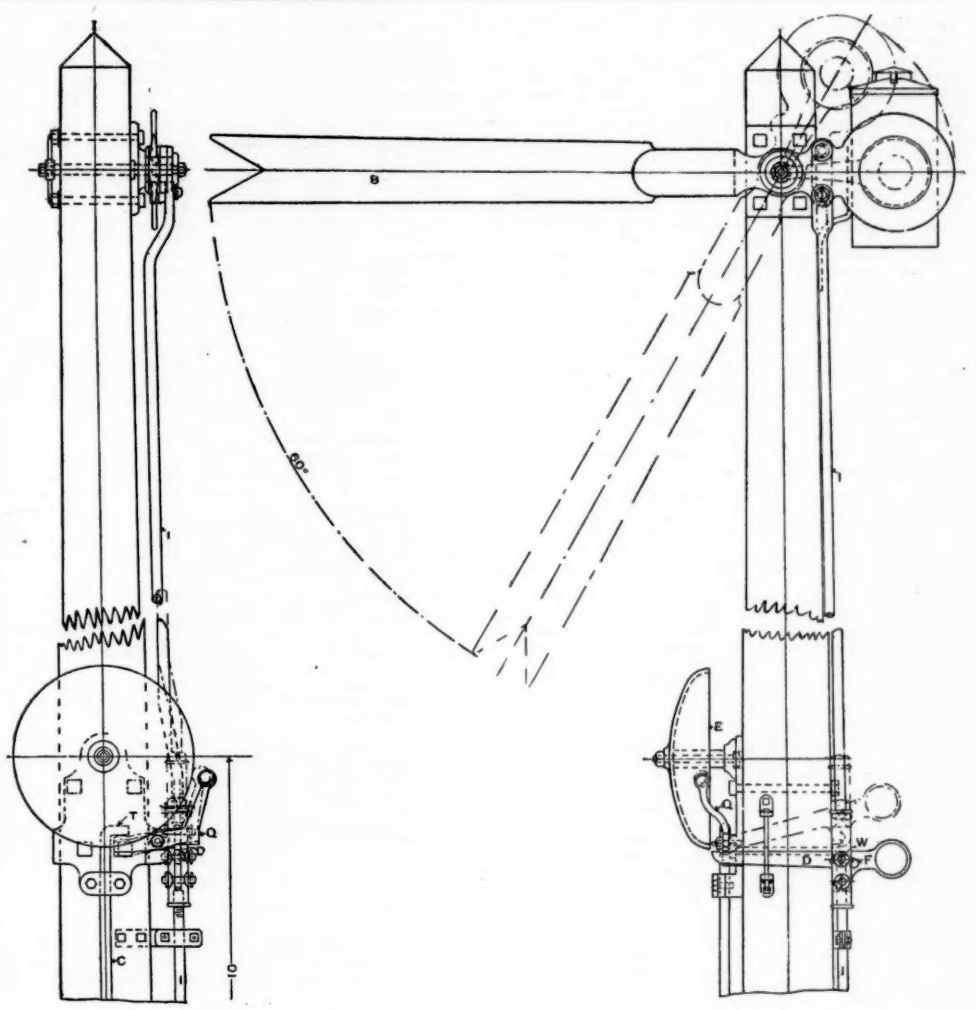
Mr. George E. Van Brunt, Master Mechanic of the Pennsylvania & Northwestern Railroad, writes regarding Smith's triple exhaust as follows: "I have had two of these pipes running for one year, in our engines Nos. 13 and 14, and have ordered three more to be placed in engines building at the Baldwin Locomotive Works, Philadelphia. I find we can haul our trains, on our heavy grades, much easier with them than with the standard exhaust. Also we find there is a saving of about 30 per cent. on coal. There is less chance of fire being thrown out of the stack on account of the exhaust being so soft. Also we find our extensions have about one-half less sparks to clean out. All engines using it are very free steamers. We have tested this pipe well on our road, as we have one of the hardest roads to operate for grades and curves in the country. I think this pipe would do a great deal better on roads that have lighter grades. The expense of cleaning the pipes on engines 13 and 14 has not been over 20 cents for the year."

The Heidelberg, Rack and Cable Road.

In connection with the recently opened mountain railroad leading to the Heidelberg Castle, Germany, it is of interest to note that, in order not to mar the natural beauties of the scenery, the road has been built underground, a tunnel leading directly to the castle. The road is of the rack rail-cable type, and the cars are provided both with hand and automatic brakes. The road is worked by means of water ballast, the cars having tanks arranged underneath the floors. Each tank has a capacity of about 8 cubic meters of water, the water supply being furnished from a reservoir at the upper terminal station. The total length of the road is 1,604 ft., the difference in level between the terminals, 564 ft., and the maximum grade 43 per cent.

Automatic Freight Car Couplers in Massachusetts.

The Massachusetts Railroad Commissioners announce that they will hold an examination of freight car couplers on July 8. Only couplers in actual use on freight cars will be examined, and application must be made at the office of the commissioners in Boston at 10 o'clock on the day named. Examination will be made on the tracks of any road in Boston. This action is in accordance with the law of 1886. Nothing is said about the occasion or the purpose of the examination, but it may be surmised that the intention is to take some action similar to that recently had in Michigan.



Kelsey's Distant Signal, with Automatic Gong Attachment.

Orders for the Air Brake.

The Westinghouse Air Brake Co. is now very busy, and is manufacturing brakes at Wilmerding and at the Allegheny works. Among recent large orders for brakes have been the following: One thousand sets for the Atchison, Topeka & Santa Fe, 2,000 for the Hicks Stock Car Co., of Chicago, 500 for the Chicago, Milwaukee & St. Paul, 4,000 for the Union Pacific, and 300 for the Street stable car line, of Chicago.

THE SCRAP HEAP.

Notes.

Detectives have just lodged in jail at Buffalo two men who have for a long time robbed freight cars on the Erie road near Portage, N. Y.

A gang of 30 tramps got control of a freight train on the Pennsylvania, near Elizabeth, N. J., one day last week. Police were telegraphed for and four of the tramps were captured after a hard fight.

The Union Pacific has ordered a reduction of 25 per cent. in the expenses of the machinery department. The working hours in the shops will be shortened and probably five per cent. of the men will be laid off. The employés in the machine shops along the line from Pocotello, Idaho, to Portland have struck on account of a reduction in their wages.

A number of conductors, said to represent 50 former local divisions of the Order of Railway Conductors, met in New York, June 22, and took steps for the formation of a new order to be confined strictly to insurance and social purposes. Temporary officers were elected, C. S. Wheaton being made President and E. C. Nash, Vice-President.

The Illinois Central has just announced that the 20 miles of the road from Fernier to Ponchatoula, La., which has been under water for the past three months, is cleared and ready for business. The Illinois Central has suffered more than any other road running into New Orleans from the effects of the high waters in the Mississippi, and for nearly three months has been compelled

to use the tracks of another road for a considerable distance.

Two railroad employés at Wyandotte Junction, Kan., were held in $5,000 bonds each at Chicago last week for robbing the mails. It is said that four other suspected men absconded to evade arrest. Heavy robberies of letters, mostly those containing checks, have been perpetrated during the past few weeks at Wyandotte, where bags are transferred from the Chicago, Rock Island & Pacific to the Burlington.

Three iron railroad bridges over a creek at Atchison, Kan., were demolished by a flood on June 19. On the same day severe damage was done in the region of Addison, N. Y. The Addison & Pennsylvania Railroad suffered severely, losing several trestles. Near Belvidere, Ill., the Chicago & Northwestern had a bad washout June 22, the second serious interruption of the kind at that point within two weeks. A cloudburst in the region of Parkersburg and Wheeling, W. Va., on Saturday night last carried off many thousand dollars' worth of timber and caused numerous washouts on the Baltimore & Ohio and the Ohio River roads. At and near Dubuque, Ia., a severe storm on June 24 destroyed two bridges of the Illinois Central between Dubuque and Julien and one of the Chicago, Milwaukee & St. Paul at Washington Mills. The Chicago, St. Paul & Kansas City was badly damaged at points for about 30 miles west and north of Dubuque.

Running 15 Miles with Crew all Asleep.

The following from the New York *Tribune* is doubtless put forth as a mixture of fact and fiction, and the reader can make his own estimate. The grade from Hilliard to Evanston averages, according to the Official Guide, 35 ft. per mile:

"We had been shooting prairie chickens in Uinta County, Wyoming, and lost our way. We had expected to strike the Union Pacific at Hilliard about sundown, but it was nearly three o'clock in the morning when we crawled up to the little station platform, tired, sore and dead fagged. We sat there shivering, waiting for the next down freight until the headlight rounded the curve and came toward us shivering and tottering, as it seemed, in the darkness. We did not expect to be able to stop the train, but the grade was slight here, and as all trains from Piedmont to Evanston are run 'on grade' only, we had determined to jump the train. S—— was to take the engine at the cab door. That left for me the caboose at the end, or possibly the emigrant cars, if the train carried any. It is next to impossible to jump a freight car, as there are no steps and no handles to seize as you make the spring. I was to climb up, walk along the freight cars and join S—— in the engine where it was warm and where we could talk to the engineer and fireman. . . . I spied my chance on an emigrant car, and I was safe on board. I had not expected to find an emigrant train, but when I landed on the platform of the first coach I opened the door and went in. Everyone, including a brakeman, was fast asleep. I went through the three cars and back to the caboose. Everyone fast asleep. Then I walked back through the cars, and climbing to the top of the last freight car, started to walk ahead to find S——. I met him coming my way, as he was afraid I had not made my connection and had been left behind.

"'The engineer and fireman are both sound asleep,' he said.

"Then everyone 'on this train is asleep,' I answered, 'and there are a hundred or so of immigrants back there'

"We went ahead, and I getting down to the tender sat on the coal and looked at the engineer and fireman. From Hilliard to Evanston the grade increases and it is a lively run. The train went ahead at a smashing rate, not a single brake being on, but both men in the cab slept on peacefully. It was full daylight when we entered the cut above Evanston. S—— shook the engineer heavily there. "Better wake up," he said. "You are running into town at a passenger speed."

"'Who's asleep?' said the engineer, gruffly, springing up and rubbing his eyes as he looked at his big silver watch. 'What are you doing in here?'

"'Oh,' said S——, with a laugh, 'I've been watching over your slumber for an hour or more.'

"At this the engineer's savageness suddenly disappeared. It was down brakes then, and the long train came to a standstill. The fireman meanwhile had been wakened, and looked sheepishly at his superior. Each had trusted the other.

"'What are we lying here for?' asked S——.

"'Twenty minutes ahead of time,' said the engineer, meekly. 'Say,' he added, eagerly, 'you've saved my head on this. Don't say anything about it, will you?'

"Twenty-three minutes later No. 8 pulled into Evanston on time to the second."

An Italian Rack Railroad.

The new railroad up Monte Generoso has just been opened, an interesting fete marking the occasion. The course of the new railroad was traversed from Capolago to the summit, which is 5,560 ft. above sea level, in little over an hour. The track is narrow gauge, with a double rack in the centre, on which two cogwheels of the engine run, and the total length is nearly six miles. The gradient varies from 20 to 22 in 100. The movement is smoother even than that of the Rigi line, and infinitely easier than that of the Pilatus railroad. Beautiful views are enjoyed along the route, and from the summit there is a glorious panorama over the Alps, Lakes Como, Maggiore and Lugano, and to the south over the plains of Lombardy as far as Milan. Two stations have been made on the way, and at Bella Vista a large hotel stands for the accommodation of tourists. The picturesque surroundings of Monte Generoso are thus brought within easy reach.—*London Times*

Life Saved by a Railroad Accident.

A dispatch from Parkersburg, W. Va., June 18, says: The railroad disaster several days ago, on the Chesapeake & Ohio, near Ashland, in which a number of persons were killed (presumably at a highway crossing) was the means of saving the life of Azero Polly. He was about to be tried on a charge of having assaulted Miss Julia Hester, the penalty for which crime in this state is death. The only witnesses were the girl herself, her sister and her mother. All three were killed in the disaster, and the case against Azero has been dismissed for want of testimony against him.

Trains Stopped by Caterpillars.

An army of caterpillars overran the New Brunswick Railroad one day last week near Fredericton, N. B., covering a distance of half a mile and rendering the rails so slippery that the wheels of the locomotives revolved without progressing. The appearance of these pests so early in the season, indicates, it is feared, another such plague as that of twelve years ago.

Pennsylvania Voluntary Relief Department.

The members of the Pennsylvania Voluntary Relief Department (west of Pittsburgh) have elected their six representatives on the advisory board. The total vote cast was 8,578, and 226 candidates were voted for. The following were elected: M. H. Greenan, engineman, of Indianapolis; Samuel F. Johnson, passenger conductor, of Logansport; Wilber Robertson, passenger conductor, of Indianapolis; Charles C. Keller, clerk, of Pittsburgh; Morris V. Miller, engineman, of Ashtabula; Horace Whitcomb, machinist, of Dennison. Mr. Greenan was the only member of the old board re-elected.

The sick list is now below 400 and is about down to the normal percentage. Since Jan. 1 there has been a slight decrease in membership, owing chiefly to resignations from service and no special effort to secure additional membership.

Glimpses of Life in America.

To Clara: You inquire when it is that self-denial achieves its supreme victory. The question is a difficult one. Try traveling in a private car without divulging that it was that sort of a car that carried you, and see if it does not give your self-denial an awful wrench.—*New York Tribune.*

New African Railroads.

Several applications have recently been made to the Portuguese government for concessions to build new railroads in Africa. One of the roads is to connect the Limpapo River with the Transvaal frontier; another is to run along the Transvaal frontier, and still another to run from this frontier into the coast district of Inhambane. Land grants have been asked for for mining operations and the establishment of colonies.

A Female Railroad Contractor.

Miss Fannie Williams, the female railroad contractor, has begun work at Wellington, O., on her 25-mile contract of grading for the Cleveland & Wellington Railroad, according to the press dispatches. A large number of men and horses aer employed under her supervision. She has just completed a contract on a branch of the Mackey system.

Baltimore & Ohio Improvements at Pittsburgh.

It is stated that the Baltimore & Ohio will expend about $400,000 in improving its Pittsburgh facilities this year. A new freight depot will be built, covering an entire block along the Monongahela River. A new 20-stall roundhouse and large freight sheds are also to be constructed. The company has purchased about 30 acres of ground near Glenwood, about five miles from the city, for storage tracks and yards.

Patent Infringement Suit.

The Ashton Valve Co., of Boston, has just begun suit against the Coale Muffler & Safety Valve Co., of Baltimore, for infringement of patents. Damages are placed at $50,000. The trial will take place at Baltimore.

LOCOMOTIVE BUILDING.

The Norfolk & Western last week received two ten-wheel passenger locomotives from the Rogers Locomotive Works.

The Roanoke Machine Works, of Roanoke are building one new locomotive a week and are so crowded with orders that the road has let contracts to outside firms.

The Marietta & North Georgia R. R. has just received a new ten-wheel locomotive from the Rogers Locomotive Works, at Paterson, N. J.

CAR BUILDING.

The Ohio Falls Car Co. has just received a contract from the Central of Georgia for the building of 30 passenger cars, two sleeping cars, and 100 hopper and 50 stock cars.

A number of new Pullman sleeping cars have been received for the new line between Savannah and Birmingham over the Central of Georgia and the Savannah, Americus & Montgomery.

The Rio Grande Western is receiving the last lot of 12 parlor cars ordered of the Pullman Car Co. Orders will soon be placed for new refrigerator and other freight cars, and for chair and ordinary passenger cars.

The Wabash has recently put in service between Decatur and Chicago several new heavy passenger engines, and others are being built at the Springfield shops.

Among the roads now in the market for cars are the New York, New Haven & Hartford, for 50 passenger; Pennsylvania, Poughkeepsie & Boston, about 400 freight, and Huntingdon & Broad Top, 350 freight.

BRIDGE BUILDING.

Albany, N. Y.—Proposals are wanted until July 1 for the construction of a lift bridge over the Erie Canal, in Albany, by the Superintendent of Public Works.

Birmingham, Conn.—It has been voted by New Haven County to appropriate the sum of $45,000 for the purpose of erecting a bridge over the Housatonic River, at Birmingham, Conn. The bridge will cost $90,000, and the expense will be equally borne by New Haven and Fairfield counties.

Bloomfield, N. J.—Plans for a bridge over the river at James street, Bloomfield, are being prepared by County Engineer James Owen, 721 Broad street, Newark, N. J.

Bridgeport, O.—The Bridgeport Bridge Co. has been chartered in West Virginia to build a steel wagon, foot-passenger and street-railroad bridge over the Ohio River from Wheeling Island to Bridgeport, O. The capital stock is $300,000. The incorporators are Walter D. Uptegraff and G. W. G. Ferris, of Pittsburgh, Pa., and John M. Sweeney and William P. Hubbard, of Wheeling, W. Va. These are the principal stockholders of the Wheeling Bridge Co., now building bridges to connect Wheeling, W. Va., and Martin's Ferry, O., and the new bridge is part of the same scheme.

Dresden, O.—The Smith Bridge Co., of Toledo, O., has been awarded the contract for the superstructure of a bridge over Wakatomika Creek, at Dresden, which has a 123 ft. span.

Foreman, N. D.—Proposals are wanted until July 7, for the erection of a bridge over the Wild Rice River. Charles Afdem, of Foreman, is County Auditor.

Harper's Ferry, W. Va.—The London Bridge Co. was chartered in West Virginia last week for the purpose of building a bridge across the Shenandoah River at Harper's Ferry.

Lynchburg, W. Va.—The contract for the bridge to be built from the head of Main street, Lynchburgh, to Daniel's Hill, by the Rivermont Land Co., has been awarded to the Edge Moor Bridge Works, of Wilmington, Del., for $68,000. The bridge is to be completed within four months.

Meriden, Conn.—It is proposed to bridge the railroad tracks at Cooper street, in this city.

Minneapolis, Minn.—The following bids were received for the Second Avenue bridge. It will be of iron, with four spans 506 ft. long and an 18-ft. roadway, and walks 6 ft. wide on either side: Milwaukee Bridge Co., $35,370; Canton Wrought Iron Bridge Co., $38,900; Shiffler Bridge Co., $40,600; Chicago Bridge & Iron Co., $35,518; Keystone Bridge Co., $43,600; King Bridge Co., $43,000; Wisconsin Bridge Co., $39,257; South Bridge Co., $42,498.

Pittsburgh, Pa.—The second span of the Ninth Street bridge, in Pittsburgh, has been placed in position. McCauley & Morsee are the engineers. The piling for the third span will be begun the latter end of this week and the bridge will be completed in the early autumn. The same firm expects to erect 2,000,000 ft. of wooden trestle for the Wheeling & Lake Erie, over their extension from Steubenville to Portland, O.

Pueblo, Col.—An iron bridge, to cost about $10,000, is to be erected at this place.

Quincy, Mass.—The County Commissioners have been asked to enlarge the overhead bridge and approaches over the Old Colony road at Hancock street, in Quincy.

Riverton, Va.—The bridge which the Front Royal & Riverton Improvement Co. proposes to build at once at this place will be 300 ft. long and will cross the Shenandoah River. Geo. W. Cone, of Riverton, Va., is Vice-President.

St. Louis.—Bids were received by the Board of Public Improvements last week for the construction of a bridge over the River des Peres, on Broadway. The lowest bid was $19,811, by A. Geisel & Co. The board's estimate was $16,000. New bids will probably be asked.

Seattle, Wash.—Proposals, accompanied by plans and specifications, will be received by the Board of Commissioners of King County until July 7, for the construction of a bridge over Green River, on the Simpson road. The bridge is to have a span of 100 ft., and be 12 ft. wide in the clear. W. R. Forrest is County Auditor.

Toledo, O.—A heavy plate girder iron bridge is being built for the Wheeling & Lake Erie road, over Green Creek, where a temporary trestle has replaced the structure recently burned.

Trenton, N. J.—The following bids for the construction of an iron bridge were recently received by Symmes B. Hutchinson, County Solicitor: New Jersey Steel & Iron Co., Trenton, N. J., $1,435; Milliken Bros., 55 Liberty street, New York City, $1,560; King Iron Bridge Co., $1,520; Dean & Westbrook, $1,510; Variety Iron Works, Cleveland, O., $1,700; Finley & Lachicotte, York, Pa., $1,780; Groton Bridge Co., Groton, N. Y., $1,780; Berlin Bridge Co., $1,575.

Tuscarora, N. Y.—A new iron bridge has been placed over the Kishequa Creek at Tuscarora on the Western New York & Pennsylvania road.

MEETINGS AND ANNOUNCEMENTS.

Dividends.

Dividends on the capital stocks of railroad companies have been declared as follows:

Canada Southern, semi-annual, 1¼ per cent., payable Aug. 1.

Chicago, St. Paul, Minneapolis & Omaha, 2 per cent., payable in July.

Central of Georgia, quarterly, 2¾ per cent., payable July 15.

Lake Shore & Michigan Southern, semi-annual, 2 per cent., payable Aug. 1.

Michigan Central, semi-annual, 2 per cent., payable Aug. 1.

Missisquoi Valley, 2 per cent., payable July 1.

Missouri Pacific, quarterly, 1 per cent., payable July 15.

New Castle & Beaver Valley, quarterly, 3 per cent., payable July 1.

New York, New Haven & Hartford, quarterly, 2½ per cent., payable July 1.

Richmond & Danville, 5 per cent., payable July 9.

Richmond & Petersburg, 3½ per cent., payable July 3.

Richmond & West Point Terminal, 2½ per cent. on the preferred stock, payable July 10.

Rutland 1 per cent. on the preferred stock, payable July 1.

Meetings.

Meetings of the stockholders of railroad companies will be held as follows:

Adirondack, special, adjourned, 21 Cortlandt street, New York City, July 7.

Charleston & Gauley River, special, Charleston, W. Va., June 30, to consider a consolidation with the Kanawha & Michigan.

Grafton & Greenbrier, special, Philippi, W. Va., July 18.

Kentucky Union, annual, Louisville, Ky., July 21.

Memphis & Charleston, special, Memphis, Tenn., July 9.

Missouri Pacific, special, St. Louis, Mo., July 15.

Mobile & Girard, annual, Girard, Ala., July 2.

Pratt Coal, Iron & Railway Co., special, Birmingham, Ala., June 28.

St. Louis & San Francisco, special, St. Louis, July 21, to vote on the proposition of an increase of the common stock of the company.

Railroad and Technical Meetings.

Meetings and conventions of railroad associations and technical societies will be held as follows:

The *Association of American Railway Accounting Officers* will hold its next annual meeting at the Stockton Hotel, Cape May, N. J., July 9.

The *National Association of General Baggage Agents* will hold its next annual convention at Chicago, Ill., July 16.

The *Traveling Passenger Agents' Association* will hold its next annual convention at Buffalo, N. Y., August 19.

The *New England Roadmasters' Association* will hold its eighth annual meeting at Boston, Mass., Aug. 20 and 21.

The *American Society of Railroad Superintendents* will hold its annual meeting in New York City on the day preceeding the fall meeting of the General Time Conven

tion. C. S. Gadsden, Charleston, S. C., is President, and C. A. Hammond, 350 Atlantic avenue, Boston, is Secretary.

The *New England Railroad Club* meets at its rooms in the United States Hotel, Beach street, Boston, on the second Wednesday of each month, except June, July and August.

The *Western Railway Club* holds regular meetings on the third Tuesday in each month, except June, July and August, at its rooms in the Phenix Building, Jackson street, Chicago, at 2 p. m. The Club has adjourned until Tuesday, Sept. 16.

The *New York Railroad Club* meets at its rooms, 113 Liberty street, New York City, at 7:30 p. m., on the third Thursday in each month.

The *Central Railway Club* meets at the Tifft House, Buffalo, the fourth Wednesday of January, March, May, August and October.

The *Northwest Railroad Club* meets on the first Saturday of each month in the St. Paul Union Station at 7:30 p. m.

The *Northwestern Track and Bridge Association* meets on the Saturday following the second Wednesday of each month at 7:30 p. m. in the director's room of the St. Paul Union station, except in the months of July and August.

The *American Society of Civil Engineers* holds its regular meetings on the first and third Wednesday in each month. at the House of the Society. 127 East Twenty-third street, New York.

The *Boston Society of Civil Engineers* holds its regular meetings at the American House, Boston, at 7:30 p. m. on the third Wednesday in each month. The next meeting will be held the third Wednesday in September.

The *Western Society of Engineers* holds its regular meetings at its hall, No. 67 Washington street, Chicago, at 7:30 p. m., on the first Tuesday in each month.

The *Engineers' Club of St. Louis* holds regular meetings in the club's room, Laclede Building, corner Fourth and Olive streets, St. Louis, on the first and third Wednesdays in each month.

The *Engineers' Club of Philadelphia* holds regular meetings at the House of the Club, 1,122 Girard street, Philadelphia.

The *Engineers' Society of Western Pennsylvania* holds regular meetings on the third Tuesday in each month, at 7:30 p. m., at its rooms in the Penn Building, Pittsburgh, Pa.

The *Engineers' Club of Cincinnati* holds its regular meetings at 8 p. m. on the third Thursday of each month at the Club rooms, No. 24 West Fourth street, Cincinnati.

The *Civil Engineers' Club of Cleveland* holds regular meetings on the second Tuesday of each month, at 8:00 p. m., in the Case Library Building, Cleveland. Semi-monthly meetings are held on the fourth Tuesday of the month.

The *Engineers' Club of Kansas City* meets in Room 200, Baird Building, Kansas City, Mo., on the second Monday in each month.

The *Engineering Association of the Southwest* holds regular meetings on the second Thursday evening of each month at 8 o'clock, at the Association headquarters, Nos. 63 and 64 Baxter Court, Nashville, Tenn.

The *Civil Engineers' Society of St. Paul* meets at St. Paul, Minn., on the first Monday in each month.

The *Montana Society of Civil Engineers* meets at Helena, Mont., at 7.30 p. m., on the third Saturday in each month.

The Civil Engineers' Club of Kansas holds regular meetings on the first Wednesday in each month at Wichita, Kan.

Boston Society of Civil Engineers.

A regular meeting was held June 19 at the American House, Boston, Vice-President J. R. Freeman in the chair. Forty-nine members and 20 visitors present. The following were elected members: Francis Blake, Weston, Mass.; Frank P. Johnson, Waltham, Mass.; George H. Nye and George C. Stoddard, New Bedford, Mass. Edward P. Fisk, Boston, was elected an associate.

The treatment of sewage was the subject for discussion. Mr. Hiram F. Mills, C. E., member of the State Board of Health, read the first paper, entitled "Purification of Sewage by Filtration and by Chemical Precipitation." Mr. Mills gave a very full description of the experiments which have been conducted under his direction, by the State Board of Health, at Lawrence, upon the treatment of sewage. Mr. Charles A. Allen, City Engineer of Worcester, followed with a paper describing the new Sewage Disposal Works built in that city, and gave the reasons which led him to recommend chemical precipitation as the best method for disposing of the sewage of the city. Mr. Wilbur F. Learned, Assistant Engineer, Boston Water Works, read a paper showing the results obtained in the treatment of sewage at Winchester, Mass. After discussing the several papers, the Society adjourned to the third Wednesday in September.

Civil Engineers' Club of Cleveland.

A regular meeting was held June 10, President Searles in the chair, 28 members and two visitors present.

Mr. Mordecai, Chairman of the Committee on Affiliation with the American Society of Civil Engineers, reported that he had requested Mr. Holloway to represent the club at the coming conference of engineering societies in New York. A letter was read from the Engineers' Club of St. Louis, accompanying a printed statement of the views of that club on affiliation with the American Society, which was referred to the Committee on Affiliation.

A letter to the President from Dr. R. W. Raymond, Secretary of the American Institute of Mining Engineers, requesting him to represent the club at the autumn convention was read, and some announcements were made regarding the expected visit to this country of the Iron and Steel Institute of Great Britain.

The chair appointed C. G. Force, Prof. Chas. S. Howe, G. W. Vaughan, Hiram Kimball and Geo. E. Hartnell a committee to arrange for a picnic to be held at Rocky Point the latter part of July.

Albert H. Porter was elected Secretary. The following members were also elected Associate: Joseph Daniels, Thomas M. Irvine and William L. Otis; Active: Edward P. Roberts, William H. Dunn, James C. Hallsted, John H. Hilton and William F Biggar.

Dr. Herman Poole read a paper on "Ferroid—A New Artificial Stone," which was followed by discussion. Prof. Chas. S. Howe read a paper on the "Almucanter,' a new instrument for field astronomy, greatly simplifying observations and calculations for time and latitude, and resulting in a degree of accuracy scarcely excelled by the most elaborate instruments on solid foundations. This was illustrated by a large drawing prepared by Professor Saunders, member of the Club.

Engineer's Club of St. Louis.

The club met June 15, Vice-President Burnet in the chair; 17 members and three visitors present. An appliation for membership was received from Richard Klemm, Park Commissioner of St. Louis.

The secretary read a communication from the Chairman of the Board of Managers of the Association of Engineering Societies, calling attention to certain amendments to the articles of association, which had been adopted by the board, and were now being submitted to the societies for ratification. It was ordered that a special committee of three be appointed to consider this matter and report at the next meeting. Messrs. J. A. Seddon, B. L. Crosby and W. H. Bryan were appointed such committee.

The secretary read Prof. Chas. C. Brown's paper on "River Pollution in the United States." The author divided the treatment of his subject into three heads: First, streams used for water supply only; second, streams used for drainage purposes only; third, streams used for both water supply and drainage. The paper was confined principally to the consideration of the latter class, as being the most important. The author gave abstracts of the work done in different states heretofore in the direction of investigating the pollution of streams, accompanying his remarks by tables showing the results of chemical analysis of a large number of different waters. After brief discussion by Messrs. Beahan, Seddon and Holman, the meeting adjourned.

Railroad Telegraphers.

The Order of Railway Telegraphers, at a meeting in New York City, last week elected H. S. Lambdin, of Columbus, O., past grand chief telegrapher; A. D. Thurston, grand chief telegrapher, and S. O. Fox, grand secretary and treasurer. The two last are from Vinton, Ia., where are the headquarters of the association. The order now numbers over 9,000 members, and is in good financial condition.

PERSONAL.

—Col. Charles Williams, formerly General Manager of the Little Rock & Memphis, died at his home at Surrounded Hill, Ark., June 29.

—Mr. W. H. Bancroft General Superintendent of the Rio Grande Western, has, it is reported, resigned the position, but the officers have not announced the change.

—Mr. Thomas C. Peck, Acting General Passenger Agent of the Ft. Wayne, Cincinnati & Louisville, will on July 1 enter the service of the Columbus, Hocking Valley & Toledo.

—Mr. John B. Shaw, of Jamestown, late Superintendent of Telegraph on the New York, Pennsylvania & Ohio, has been presented with a handsome set of silver by his recent associates.

—Mr. Walter Marcorm, General Traffic Agent of the Interoceanic road of Mexico since last June, has resigned the position. He was formerly General Freight and Passenger Agent of the Mexican National.

—Mr. Charles M. Da Costa, a Director of the Illinois Central and of the Denver & Rio Grande, died at his home in New York City this week. Mr. Da Costa was in Denver, Col., on business, in the latter part of May, when he suddenly became seriously ill, and was brought home in a private car. He had been confined to his room ever since. He was a leading authority on railroad, corporation and common carrier law.

—Mr. Frank H. Andrews, President of the Globe Iron & Spring Works, of New York City, died last Saturday, of pneumonia, after a brief illness, at his home, Cliffdale-on-the-Palisades. Mr. Andrews was 38 years old. He was for a time in the employ of the New York Car Spring Co., but eight years ago he established the Globe Iron & Spring Works. He leaves a widow, a daughter of Mr. W. C. Baker, President of the Baker Heating Co., of which Mr. Andrews was Secretary and Treasurer.

—Mr. Charles Ackenheil, Chief Engineer of the Baltimore & New York Railroad and the Staten Island Rapid Transit Railroad, was killed in a railroad accident June 20. The accident was a derailment of an express train on the Philadelphia Division of the Baltimore & Ohio Railroad, near Child's Station, and was caused by the breaking of the main rods of the locomotive. Mr. Ackenheil was in a sleeping car, which was overturned, and was so severely injured that he died within a few hours, never having regained consciousness after the accident.

Mr. Ackenheil was born in Baden-Baden, and was about 48 years of age. He was highly educated, having received the degree of civil engineer at the University of Heidelberg. He served a few years in government employ in his own country, and about twenty years ago entered the service of the Baltimore & Ohio Railroad, where, with but one brief interruption, he has been ever since. The most conspicuous work which he performed while in the service of that company was building the Pittsburgh bridge of the Pittsburgh & Wheeling Railroad, the Arthur Kill bridge, and the docks and buildings of the Staten Island ferry in New York. He was Superintendent in charge of the Chicago Division af the Baltimore & Ohio during construction, and of the Pittsburgh & Wheeling, a part of the Baltimore & Ohio system. At the time of his death he was elaborating the plans for the terminals of the Baltimore & Ohio system on Staten Island. The scheme of this work is very comprehensive, including yards and docks for deep water terminals, tide water terminals and coal docks. But a small part of the work contemplated has as yet been done, but the general plan had been laid out by Mr. Ackenheil, and some of its details worked up.

Mr. Ackenheil was a member of the American Society of Civil Engineers and a man prominent and honored in his profession. He inspired confidence not only by his recognized ability, but by his personal character. He was a man of strong and simple character and of plain manners, who gave to those who came in contact with him the feeling that he was a man of integrity and fidelity, who could be thoroughly trusted in any position which he took. He was a widower and leaves five children, whom he had recently established in a pleasant home on Staten Island.

ELECTIONS AND APPOINTMENTS.

Bedford & Bloomfield.—At a recent meeting the following directors were elected: W. C. Winstandley, Bedford, Ind., W. L. Breyfogle, Samuel Castleman, Louisville, and N. Willis Bumstead and H. H. Campbell, Boston. The officers elected were: W. C. Winstandley, President; N. Willis Bumstead, Vice-President; W. H. Lewis, Secretary and Treasurer.

Blackville Alston & Newberry.—At the annual meeting of the road held at Blackville, S. C., June 18, the following directors were elected. Geo A. Wagener, Rudolph Siegling, H. F. Bremer. A. S. J. Perry, Charleston; A. Kline, Oil City, Pa; D. H. Salley, Salley's, S. C., Mike Brown, Alfred Aldrich, Barnwell, S. C.; Simon Brown, Blackville. The officers elected are: President, George A. Wagener, Secretary and Treasurer, Mike Brown, Auditor, H. R. Walker, and Superintendent, J. C. Kevn.

Burlington & Northwestern.—The annual meeting of the road held at Burlington, Ia., June 18, resulted in the election of the following directors and officers: T. W. Barhydt, W. W. Baldwin, John T. Remey, Norman Everson, J. W. Blythe, Lyman Cook, C. R. Squires, H. C. Garrett and H. B. Scott. President, John T. Remey; Secretary and Treasurer, R. M. Green; Superintendent, John T. Gerry.

Catonsville Short Line.—James A. Garey has been re-elected President of this company.

Chicago, Burlington & Northern.—John R. Hastings has been appointed General Superintendent of the road, with headquarters at St. Paul. The office of General Manager has been abolished and the jurisdiction of the General Superintendent will be extended over that department.

Chicago, Rock Island & Pacific.—The appointment of W. I. Allen as Assistant General Manager is reported. Mr. Allen has been General Superintendent of the lines west of the Missouri River, with headquarters at Topeka, but his headquarters will be transferred to Chicago.

Cleveland, Cincinnati, Chicago & St. Louis.—J. D. Riddell has been appointed Freight Claim Agent, with office in Cincinnati, vice C. H. Dent resigned. Mr. Riddell was formerly Traveling Freight Agent of this road, with headquarters at Cleveland, but more recently chief voucher clerk in the Traffic Manager's office.

Cleveland, Lorain & Wheeling.—John Moran, formerly Assistant Roadmaster, has been appointed Roadmaster, with office at Sterling, O., vice James Reynolds, deceased.

Dakota, Wichita & Galveston.—The incorporators of this Kansas company are: C. Eisenmayer, Jr., J. Winkler, J. D. Lange, W. F. Gehne and James Dow, all of Halstead, Kan.

Dayton & Michigan.—At a meeting of the stockholders of the road in Cincinnati June 25, the following board of directors was elected: Thomas J. Emery, of Cincinnati; J. J. Emery, of New York; Sheldon Reynolds and George Pomeroy, of Toledo; F. H. Short, R. R. Bowler, David Swinton, Frank Jones, Herbert Janney, Robert Mecke and Charles Green, of Cincinnati.

Denison, Bonham & New Orleans.—A new board of directors has been elected as follows: S. B. Allen, of Bonham, President; W. B. Munson, of Denison, Vice-President and Treasurer; L. Smith, Asst. Treasurer; W. H. Abrams, R. S. Lovett, John A. Grant, R. Fanby and L. S. Thorne, of Dallas; George J. Gould, of New York; Paul Wapley, of Denison.

Ft. Wayne, Cincinnati & Louisville.—The general offices of this road will be removed from Ft. Wayne to Indianapolis on July 1. The jurisdiction of the officers of the Lake Erie & Western has been extended over the road in the following positions: George L. Bradbury, General Manager; D. S. Hill, General Superintendent; O. W. Bell, Master of Transportation; H. C. Parker, Traffic Manager; S. B. Sweet, Assistant General Freight Agent; S. A. Wikel, Assistant General Freight Agent; C. F. Daly, Assistant General Passenger Agent; W. A. Wildhack, Auditor; A. D. Thomas, Assistant Treasurer; P. Reilly, Superintendent of Equipment, Lima, and T. H. Perry, Chief Engineer and Purchasing Agent.

Grand Rapids & Indiana.—E. C. Leavenworth, at present Acting General Freight Agent, has been appointed General Freight Agent, with office at Grand Rapids, Mich. In addition to his duties as General Freight Agent Mr. Leavenworth will continue to have charge of the car accounts and distribution.

Louisiana & Northwest.—Felix C. Murphy has been appointed Secretary and Auditor of the road, with headquarters at Gibbsland, La.

Manitoba & Puget Sound.—Frank Wood has been appointed General Manager of the road, to take effect July 1. He was formerly a conductor on the Chicago & St. Louis branch of the Wabash road.

Middle Georgia.—Among the projectors of this road are: H. N. Hollifield, Col. R. L. Wharthen, Hon. B. D. Evans, Sr., W. Rawlings, Dr. J. I. Irwin, C. R. Pringle, M. Newman, S. G. Jordan and J. N. Gilmore. At a recent meeting of projectors in Sandersville, Ga., M. Newman was elected President and H. N. Hollifield Secretary and Treasurer.

New York, Ontario & Western.—M. C. Carr has been appointed Freight and Passenger Agent of the Scranton division of the road, with office at Scranton, Pa.

Northern Pacific.—The following changes have recently been made: E. H. McHenry, appointed Principal Assistant Engineer in charge between Billings, Mont., and Hope, Idaho Ter., with headquarters at Helena, Mont.

Newman Kline, Assistant Superintendent of Transportation, with headquarters at Helena, has been promoted to the position of Principal Assistant to the General Manager, with headquarters at St. Paul, Minn.

Northern Pacific Terminal.—The following directors were elected at the annual meeting of the road, held at Portland, Or., June 16: Henry Failing, H. W. Corbett, C. J. Smith, C. P. Huntington, J. B. Williams, R. Koehler, Paul Schulze, C. A. Dolph and G. M. Lane.

Ogden & Hot Springs.—The officers of this road are: President and Treasurer, W. B. Farr; Secretary, I. W. Lapentz, and Chief Engineer, F. A. Calkins, all of Ogden, Utah Ter.

Ogdensburg & Lake Champlain.—At the annual meeting of the stockholders of the road, held at Ogdensburg, N. Y., June 18, the old Board of Directors was re-elected.

Oregon Improvement Co.—The following Board of Directors was elected at Portland, Or., June 16: Elijah Smith, C. A. Dolph, James H. Benedict, S. H. Thayer, Prosper W. Smith, Henry Failing, C. H. Lewis, C. J. Smith, William Ladd and Jonathan Bourne, Jr.

Oregon Railway & Navigation Co.—At the annual meeting of the company, held at Portland, Or., June 16, the following were elected as directors: Edmund Smith, C. F. Adams, W. B. Fosdick, H. R. Reed, F. L. Ames, G,

M. Lane, H. Thompson, C. J. Smith, William McIntosh, W. W. Cotton, A. L. Mills, Lloyd Brooks and H. C. Campbell.

Oregon & Transcontinental.—The old Board of Directors was re-elected at the annual meeting at Portland, Or., June 16, with the exception of T. H. Bartlett, M. G. Hall and A. D. Charlton. The following were elected in their places: Rufus Mallory, C. A. Dolph and T. H. Tyndale, of Portland.

Orleans, West Baden & French Lick.—At a meeting of the road, held in New York City, recently, William Dowd, Elihu Root, John B. Carson, R. G. Rolston and Joel B. Erhardt resigned from the board and the following Louisville, New Albany & Chicago directors were elected in their places: H. H. Campbell, Allan G. Lamson, of Boston, J. B. Hughes, of Chicago, W. L. Breyfogle and Samuel Castleman, of Louisville. The officers elected were H. H. Campbell, President; John B. Hughes, Vice-President; W. H. Lewis, Secretary and Treasurer.

Pennsylvania Midland.—The following are the incorporators of this Pennsylvania road: John Jermyn, Scranton, President, Pa.; D. M. Jones, Reese G. Brooks, John H. Fellows, Henry M. Edwards and Smith B. Mott, all of Scranton, and George John, of Audenried, Pa., Directors.

Portland & Puget Sound.—The directors elected at the annual meeting held at Portland, Or., June 16, are: C. J. Smith, W. W. Cotton, D. P. Thompson, E. Cookingham, C. Y. Holcomb, W. A. Holcomb, C. Y. Adams, T. L. Ames and G. M. Lane.

Quincy, Keokuk & Chicago.—The incorporators and first Board of Directors of this Illinois road are: G. W. Kretzinger, Ft. Madison; Charles Gibson, C. R. Arnold, A. C. Reed, Chicago; C. A. McLaughlin, Galesburg; S. S. Gray, Hamilton; William Hill, James F. Crawford, Warsaw, and James M. Bishop, Quincy.

Rio Grande Southern.—The officers of this road are: President, Otto Mears; Vice-President, Henry R. Walcott; Secretary, John L. McNeil, all of Denver, Colo., and Chief Engineer, C. W. Gibbs, Dallas, Colo.

Rio Grande & Utah.—The stockholders of the road held a meeting at Santa Fe, N. M., June 16, and a new Board of Directors was elected. Benjamin L. Cook was elected President, and Geo. D. Cook, Secretary and Treasurer.

Roanoke & Southern.—The following directors and officers were elected at the annual meeting at Roanoke, Va., June 18: E. H. Stewart, J. M. Gambill, R. A. Buckner and A. Lewis, Roanoke; C. H. Fogle, J. E. Gilmer, G. W. Henshaw, J. W. Alspaugh, Jas. A. Gray and F. I. Stone, Salem; P. P. Watson, J. H. Mathews, C. B. Bryant, S. G. Sheffield and J. G. Coan, Martinsville. President, H. S. Trout, Roanoke; First Vice-President, J. W. Fries, Salem, N. C.; Third Vice-President, J. H. Spencer, Martinsville.

Rome & Clinton.—At the annual meeting of the road held at Rome, N. Y., June 18, the following directors were elected: B. J. Beach, W. H. Tuller, Henry Johnson, G. V. Selden, F. A. Elliott, I. R. Miller, C. H. Smyth, Ellery Stebbins, C. D. Hayes, J. I. Scollard, George B. Phelps, D. N. Crouse and E. H. Shelley. The following officers were elected: James I. Scollard, President; B. J. Beach, Vice-President; C. D. Hayes, Secretary and Treasurer; B. J. Beach, G. V. Selden, C. H. Smyth and Ellery Stebbins, Executive Committee.

St. Louis, Kansas City & Colorado.—The following changes were recently made, taking effect July 1: J. D. Springer, of Chicago, elected Director, vice S. T. Emerson, resigned; E. Wilder, Topeka, Kan., Secretary and Treasurer, vice John Gallup, Jr., resigned; A. Douglas, St. Louis, Auditor, vice John Gallup, Jr., resigned; L. C. Deming, Boston, Assistant Secretary, vice G. L. Goodwin, resigned, Mr. Goodwin retaining the position of Assistant Treasurer; H. L. Morrill, St. Louis, General Manager, vice S. T. Emerson, General Superintendant and Chief Engineer, resigned.

Savannah, Americus & Montgomery.—W. N. Marshall, Superintendent, has been appointed General Superintendent of this company, with headquarters at Americus, Ga.

Tacoma & Lake City.—At a meeting of the road at Tacoma, Wash., June 13, the following directors were elected: C. J. Smith, Portland; W. H. Effinger, F. C. Ross, G. W. Balch, Henry Drum, Tacoma; H. V. Gates, Cheyenne. The directors elected the following officers: C. J. Smith, President; W. H. Effinger, Vice-President; G. W. Balch, Superintendent, and J. C. Havely, Secretary.

Toledo & Detroit.—The incorporators are George G. Hadley, George H. Ketcham, Elmer White, H. W. Rosecrans and W. W. Adams, of Toledo, O.

Union Pacific.—H. A. Johnson, Assistant General Freight Agent of the Colorado Division, has been appointed General Western Agent, with office at San Francisco, Cal.

The headquarters of the Superintendent of Machinery and Motive Power have been transferred from Omaha to Cheyenne, Wyo., and that of the General Manager of the Missouri division to Kansas City.

Wadley & Mount Vernon.—The officers of this road are: T. J. James, President and Purchasing Agent, Atlanta, Ga.; F. M. Fremont, Vice-President, Atlanta, Ga.; Abel James, General Superintendent, Wadley, Ga., and W. J. Donovan, Secretary and Treasurer, Wadley. The general offices are at Wadley.

RAILROAD CONSTRUCTION,

Incorporations, Surveys, Etc.

Baltimore & Ohio.—It is stated that the company has decided to begin work soon on an extension of its Fayette County branch, from Uniontown, Pa., south to Morgantown, W. Va., on the Fairmount, Morgantown & Pittsburgh division. The extension will be about 24 miles long and will have a direct route from northern West Virginia to Pittsburgh.

Burlington & Missouri River.—The contract has been let to Canfield & Ryan, of Omaha, Neb., for the belt line at Lincoln, Neb., which is to extend from West Lincoln to Havelock. The line will be about three miles long.

Brunswick, Lake City & Tampa.—The company has made application for a new charter in Georgia to construct a road about 40 miles long from Brunswick to a point on the Florida State line to connect with the projected Florida Division from Lake City, north. C. Downing, W. E. Burbage, J. M. Madden, M. Ullman and others are the incorporators.

Canadian Pacific.—The company has decided to extend the Glenboro branch from Glenboro, the present terminus, to Plum Creek, Man., a distance of 45 miles, at once. The contract for grading has been awarded to Egan Bros. and J. G. Dennison. Egan Bros. have started work at Glenboro and J. G. Dennison will commence at Plum Creek when he completes his contract on the Souris branch at Melita.

Central of New Jersey.—It is rumored that the company proposes to soon construct a line from Westfield, Union Co., N. J., to Newark, and that it will carry the passenger traffic from points west of Westfield over this line.

Charleston, Sumter & Northern.—The contract has been let to the Central Carolina Land & Improvement Co., of 115 Broadway, New York City, for the grading and tracklaying on an extension of this road northerly from its present northern terminus at Sumter, through Darlington to Bennetsburg, S. C., on the Cape Fear & Yadkin Valley Road, a distance of about 63 miles. Most of the right of way has already been secured and clearing and grading is in progress. The company intends to have about 500 men working on the extension shortly, and the line will be completed in about three months. Probably no sub-contracts will be let. The route is through one of the most fertile sections of the state, and when the connection is made with the Cape Fear & Yadkin Valley the road will become an important part of a new route from central South Carolina to points in North Carolina and Virginia. J. S. Silver, 115 Broadway, New York City, is President.

Cleveland, Cincinnati, Chicago & St. Louis.—The negotiations for the purchase of the line of the Cincinnati, Sandusky & Cleveland, between Columbus and Springfield, 45 miles, not having reached a satisfactory conclusion, the company has decided to begin the construction of the proposed parallel road between these points, for which surveys were made some time ago.

Colorado Midland.—D. Shanahan & Co., of Louisville, have the contract for the construction of the Busk Ivanhoe tunnel, through the Rocky Mountains from Busk, Lake County, to Ivanhoe, Pitkin County, Colo. It is stated that the price at which the contract was let is $955,000. The tunnel will be completed in 15 months when the Hagerman tunnel will probably be adandoned. L. M. Cathert, C. H. Lee, W. H. Davidson, D. B. Ellis and E. T. Callahan as directors have incorporated the Busk Tunnel Railway Co. to build the tunnel and the connecting tracks and other work. The capital stock is $10,000,000.

Columbia & Kootenay.—The contract for building this extension of the Canadian Pacific from Sproats Landing to Nelson, B. C., a distance of 28 miles, has been awarded to Hugh Keefer and B. McGillivray, of Vancouver, B. C.

Columbus, Brownston & New Albany.—Articles of incorporation has been filed in Indiana by this company. A line will be constructed from Salem southwest to French Lick Springs.

Columbus, Shawnee & Hocking.—Tracklaying has been begun on the extension between Saltillo and Sayres, 11 miles, now being graded. This latter work is about completed. The tracklaying will be done by the company.

Dakota, Wichita & Galveston.—This is the name of the latest company of the many that have filed articles of incorporation in Kansas "for a road from Bismarck, N. D., to Galveston, Tex. The estimated length of the line is 2,000 miles, and it will pass through the counties of Sumner, Sedgwick, Harvey, McPherson, Ottawa, Cloud and Republic, in Kansas. Headquarters are provided for at Wichita, McPherson and Halstead."

Danville & New River.—This road is to be sold at foreclosure sale Aug. 27, and it is stated that it will be purchased by the Richmond & Danville. It extends from Danville, west to Stuart, Va., a distance of 75 miles.

Decatur, Chesapeake & New Orleans.—The control of this road has been recently secured by John S. Silver, of 115 Broadway, New York City, and he will soon be elected President of the company. The road was built last year through part of Lincoln County, Tenn., between Fayettevil e and Boonville, 34 miles, on the bonds of the county, issued to the company. Since this section was completed no work has been done on the road, despite several assertions of the officers that grading would soon be resumed. The Decatur & Nashville Improvement Co. has been recently organized by those who now control the line, and it proposes to complete the road between Decatur, Ala., and Shelbyville, Tenn. 125 miles. A small force has already commenced work on the grading of a 39 mile section north to Shelbyville and south from Fayetteville toward the Alabama state line. The Improvement Co. has not yet come to a definite conclusion in regard to the manner of proceeding with the work, whether to do the grading and tracklaying with forces under the direct charge of its officers or award it in short sections to sub-contractors. The men now at work are employed by the company. The force will soon be materially increased. A. Ames Howletts, of New York City, is President of the Decatur & Nashville & Improvement Co.

Denison, Bonham & New Orleans.—The reorganization has been about completed and new directors have been elected. The charter of the company is to be amended to provide for extensions to the Red River and to a connection with the Missouri Pacific in the Indian Territory, and also south through Grayson County. The division between Denison and Bonham, Tex., is to be built very soon by the Texas & Pacific. S. B. Allen, of Bonham, is President.

Denver & Rio Grande.—The contract for grading the narrow gauge extension from Villa Grove south to Alamosa, Colo., 55 miles, has been let to Levy & Moore of Walsenburg, Colo.

Easton & Northern.—The route of the road has been changed, and instead of being built to Easton, Pa., the terminal point will be at Freemansburg, Northampton County, west of Easton and several miles further up the Lehigh River.

Fairhaven & Southern.—Sub-contracts will shortly be let for the building of another 50 miles of the road, from Sedro, Wash., eastward. A portion of this distance has been graded and is ready for tracklaying.

Georgia, Carolina & Northern.—Tracklaying is now in progress at the Enoree River, 60 miles from the Savannah River, and at Greenwood, S. C., toward the Savannah River. It is expected that the two sections will be connected at the Salida River. The road is now graded to Abbeville, S. C., within 17 miles of the Savannah River, with the exception of a few miles of light work. Large forces are at work on the grading from Abbeville to within five miles of Athens. The locating survey has been made as far as Lawrenceville, on the Atlanta division, with the exception of a short section at the Appalachee River, and the contract for this work will be let immediately. Two of the piers of the Savannah River bridge have been erected, and work is in progress on the rest of the substructure.

Georgia Pacific.—The work on the double track extension of the Coalburg branch from North Birmingham, Ala., is being rapidly pushed to completion, and it will probably be turned over to the transportation department next week.

Great Northern.—Vice-President W. P. Clough is quoted as follows by a Chicago paper: The only delay to the beginning of the work on the Pacific coast extension is the definite selection of a route. The money necessary for the completion of the work was raised in London. Two days after the books were opened $10,000,000 were subscribed. We will certainly begin work on our line to the coast before September. Our surveyors have located at least three passes through the mountains and as many different routes. As soon as we decide which is the most feasible we will begin the construction of a line which will give the Great Northern the shortest route to the coast. The whole distance from St. Paul to Seattle will be about 1,725 miles.

Harriman Belt.—Fink & Ryan have the contract for the construction of the belt road at Harriman, Tenn., recently described.

Huntington & Big Sandy.—The survey is now being made from Barboursville, up the Guyandotte River, to the junction with the Big Sandy River, and the engineers are now some distance from Barboursville.

Kentucky Union.—The first train to go over the entire road from Lexington through Winchester to the Kentucky River and Jackson, in Breathitt County, a distance of 94 miles, was run June 16. Work is in progress on a short section from Jackson southerly toward Big Stone Gap, Va.

Louisville, New Orleans & Texas.—About 125 men are now working on the Tallahatchie Branch. The route is from Clarksdale south via Minter City to Yazoo City, Miss., and thence to the main line at Redwood, Miss., a distance of 152 miles. The location has been completed through to Redwood. Flynn & De Garis, of Memphis, Tenn., have the contract for grading, bridging and tracklaying. The grading from Clarksdale to Minter City, 40 miles, has been completed, and the trestles are erected on the first 10 miles, and on the balance (30 miles) this work is now in progress. Three miles of track have been laid. The line is being built through a level country, and the work is very easy. The grades and curves are at a minimum.

Macon & Atlantic.—J. S. McTighe & Co. sublet this week at their office, 316 Pine street, Macon, the first 100 miles of this road from Macon east toward Savannah, Ga., to near Excelsior, to the following contractors: Outzen & Welch, sections 1, 2 and 3; White & Co., sections 5 and 6; John Kenney, section 7; Strong, Russell & Conners, sections 9 to 20; J. B. Lewis, sections 20 to 25; S. A. Campbell, sections 25 to 30; Andrew Bros. Construction Co., sections 30 to 25; Wallace & Pearsons, sections 35 to 40; James McKinley, sections 40 to 42; McLaughlin Bros., sections 42 to 52; Garvey & Birmingham, sections 52 to 57; Sherry & Moore, sections 57 to 62; A. B. Carter & Co., sections 62 to 67; Donovan & Daly, sections 78 to 82; Henry Pearce, sections 82 to 85; Outzen & Welch, sections 85 to 90; S. McPritchett, sections 93 and 94; Baker & Sons, sections 97 to 102, Hayes Bros., sections 116 to 121. The firm still has 80 miles of the road to sublet, the contracts for which will soon be awarded.

Mariposa & Phœnix.—President Harrison has vetoed the house bill authorizing the Board of Supervisors of Mariposa County, Ariz., to issue bonds in aid of the construction of a road from Phœnix, northwardly to the county line, a distance of about 50 miles.

Mexican Roads.—The government has granted for 99 years a concession to Gonzalo A. Esteva for the construction of a road from Guadalajara to Aguascalientes. It will form a connection with the Mexican Central, giving him with his other concessions a direct line to Chamela, on the Pacific coast. For each kilometer constructed the concessionaire will receive $8,000 subsidy. All material will be admitted duty free for 15 years, and for the same period no taxes need be paid. Free right of way through the national domain is given.

Middle Georgia.—A company was recently organized at Sandersville, Ga., to build a road from that point or from Tenille north to White Plains, a distance of about 35 miles. The organization was made under the terms of a charter granted several years ago by the state of Georgia. It is understood that the road will be built in connection with the Union Point & White Plains, which projected an extension of its line south from Union Point.

Middle Georgia & Atlantic.—The company proposes to construct a branch from a point on its line near Covington, Ga., north to Social Circle, on the Georgia road, a distance of about 12 miles.

New Roads.—A narrow gauge road is to be built from Baker City, Or., on the Union Pacific, about 25 miles, into Pleasant Valley, through an extensive lumber district. Right of way is being obtained. The road will use the rails and narrow gauge equipment of the Utah Northern, which is being made standard gauge. Among the projectors are Mr. Eccles and Charles Nibley, of Ogden, and W. W. Riter and John Sharp, of Salt Lake City. Joseph R. West, of Ogden, is Chief Engineer.

Northern Pacific.—The company is building a line from Centralia west to Ocosta, on the south shore of Gray's Harbor, Wash., a distance of about 68 miles. A line is also to be built from Lakeview to Chehalis Valley, 44 miles. All the surveys have been completed and the contract for grading has been let to Grigg & Heustis, of Tacoma, Wash.

The contract for the tracklaying on the entire line from Chehalis to Gray's Harbor has been awarded to

Mathews & Kerch, of Butte Point. This work has already begun.

North Texas & Gulf.—The company has filed a charter in Texas for the purpose of constructing a road from near Jefferson toward Sabine Pass, a distance of 230 miles. E. W. Taylor, of Forth Worth; C. A. Ginochio, of Marshall; G. M. D. Grigsby, of Jefferson, and others are the incorporators. The capital stock is $1,000,000.

Ogden & Hot Springs.—The tracklaying has been begun on this road and has been finished on about two miles. All the grading has been finished between Ogden and Hot Springs, Utah, 8¼ miles. The maximum grades are 3.8 per cent. F. A. Calkins, of Ogden, is Chief Engineer.

Paducah, Tennessee & Alabama.—Work is in progress near Paducah and south of Murray, Ky., 20 miles from Paducah, under the sub-contractors. The company must complete its line and have it in operation from Paducah through Benton and Murray, Ky., to the state line, about 12 miles north of Paris, Tenn., by Oct. 1, in order to receive the subscription by Calloway County.

Pennsylvania Midland.—This company has been incorporated in Pennsylvania for the construction of a road in Monroe and Lackawanna counties, 50 miles in length, extending from a point on the Delaware River at or near Stroudsburg to a point on the Lackawanna River at or near Scranton. The capital stock is $3,000,000. John Jermyn, of Scranton, Pa., is President.

Point Atena Land & Improvement Co.—This company was incorporated at Tacoma last week, with a capital stock of $100,000. It proposes to build a road from a point on Gig harbor to a connection with the Port Townsend & Southern on Hoods Canal.

Portland & Puget Sound.—Kilpatrick Bros. & Collins, who have the contract for this road, will begin work at Centralia, Wash., early next month. This is the corporate name for the extension of the Union Pacific, which has been located from Portland, Or., to the Puget Sound and across the Columbia River, at Vancouver. The section between Centralia and Olympia and Tacoma will be the first to be built. The recently purchased Tacoma & Lake City will form part of this division. It is at present about 10 miles long, but will be extended south from its terminus near Tacoma to connect with the line from Centralia.

Portland & Rochester.—The contract for grading a short double track extension of this road through the city of Portland, Me., has been let to Richard D. Shanahan, of Portland. The expense of the work embraced in this contract will probably be about $40,000. The line will connect with the present tracks, west of Green street, and extend westerly, crossing Grove street by an overhead iron bridge, and continuing through a deep cut to connect with the Maine Central tracks south of its Portland street bridge. An iron bridge will be built near the end of the cut to carry the tracks over the junction of Portland and St. John streets. The width of the roadway will be 66 ft. The bridge at Portland street will have granite abutments. The specifications call for 44,408 cu. yds. of common excavation, 16,000 yds. of embankment, 350 yds. of retaining wall, and 2,000 yds. of bridge masonry. The bridges are to be laid in cement and cut granite of the second class. The company will do the trestle work and culvert masonry. There will be an 18½-ft. cut at Grove street. The width of the grade will be 34 ft., with transverse slope. The excavation in the rock will be 29 ft. The greater part of the earth excavated will be hauled to the foot of Elm street to be used for the ground of the proposed new union station. The extension will be 3,700 ft. in length and will cost $85,000, the largest item being for labor. The extension is not to take the road to the union station, but to bring the Boston & Maine and Grand Trunk roads to the Back Bay, where a new Union station will be erected at the foot of Preble street to be used jointly by the Boston & Maine, Grand Trunk and Portland & Rochester. The work will be finished in the fall.

Richmond & Danville.—The extension of the Northwestern North Carolina Division from Winston to Wilkesborough, N. C., 70 miles, is now about completed to the latter point. About 43 miles of track has been laid this year from Siloam west. About seven miles of track has also been laid on the Western North Carolina Division from Rhodo Station to Murphy, N. C.

Rio Grande Southern.—Fully 1,500 men are working on this road and this force is to be increased as rapidly as the contractors can engage the men. The road is being built southerly from Dallas, Colo., through Telluride and Rico to Durango. The line will connect two divisions of the Denver & Rio Grande. The distance is 185 miles. Telluride and Rico are great mining camps and Durango has very large coal deposits. The line is being rapidly built and tracklaying was begun at Dallas last week. Trains will probably be running to Telluride in less than six weeks. It is expected that the entire line will be finished before next January. There is some heavy work but noheavy grades or curves. Carlile & Wetherbee, of Pueblo, are the contractors. C. W. Gibbs of Dallas, is Chief Engineer.

Rio Grande & Utah.—A new board of directors has been recently elected and it is claimed that they will have work resumed shortly on the line between Algodones, N. M., and Durango, 40 miles.

Rio Grande Western.—The proposed extension from near Springville, Utah, to the Tintic mines is to be built to utilize the narrow gauge equipment and material released from them ain line on account of the widening of the gauge to standard. There are two routes under consideration, one from the main line at Lehi around the north point of Utah Lake; thence along the west shore of the lake crossing the south end of Cedar Valley, and thence via Bolter Pass to Eureka, a distance of about 54.5 miles. The second route is nearly the same, except at the start. It leaves the main line at Springville, and extends around the south end of the lake, and is considerably longer than the first, but has the advantage of running through several thriving towns south of Springville. There are two locating parties now in the field engaged on preliminary locations. No heavy work is encountered until within three miles of Eureka, and this can be avoided by sharp curvature. With this exception the maximum curve is 8 degrees. The maximum grade for trains going West is 1.5 per cent., and for trains going East it is 1.0 per cent. It is expected that contracts will be let, and work begun as soon as the relative advantages of the two routes are fully determined. E. J. Yard is Resident Engineer.

In referring last week to the completion of the standard gauging of the main line between Ogden and Grand Junction, the cost of changing the line to standard gauge and in purchasing the new equipment therefor was given as $1,500,000, but the outlay for these purposes has already been over $4,000,000; the expense of completing some additional work which yet remains to be done, and of a large amount of new rolling stock, which will soon be ordered, will make the total cost of the work about $5,000,000. The first standard gauge train was run June 10. The greatest care has been taken in the reconstruction of the line, to make a solid roadbed, and to reduce grades and curves. The maximum curvature has been reduced from 20 degrees to eight degrees; the total reduction in curvature in the whole line being about 8,000 degrees. The road will be rock ballasted. On many sections the old line has been abandoned and shorter sections built. The actual distance saved between Salt Lake City and Grand Junction by the shortening of the line is 18 miles. The grades in no instance on the new line are over one per cent. except for a distance of about six miles in going east over the mountain between Thistle and Helper, and 12 miles through Price Cañon going west. An extra engine will help draw the trains over this grade, and this is the only place on the entire road where this will be necessary. One engine is hauling trains of seven heavily loaded cars from Green River over the mountain to Provo. The longest stretch of new track is between White House and Crevasse, where 56 miles of the old line was reduced to 44 miles, taking the line down to the Grand River at West Water.

The present new equipment consists of eight first-class and eight second-class cars, eight mail and express and eight baggage and two combination cars. These cars were built by the St. Charles Car Co., and are all strongly built, the passenger cars being very handsomely finished. Twelve new Pullman parlor cars will be used. There are 25 freight consolidation engines, with 20×24-in. cylinders and four pairs of 46-in. drivers, built by the Baldwin Locomotive Works; also ten passenger engines from the New York Locomotive Works at Rome, N. Y., six being for mountain work with 18×24-in. cylinders, and four for running across the desert with 17 × 24-in. cylinders, the entire lot having 54-in. wheels. In the reconstruction 34,000 tons of 65-lb. steel rails were bought from the Illinois Steel Co., and 700,000 new ties were used. The road has leased 18 miles of road from the Denver & Rio Grande, from the state line to Grand Junction, for 50 years, and has secured joint yard and terminal facilities with that line.

The extension from Thistle to San Pete and Sevier Valley will be 175 miles. The grading is now completed to the asphaltum beds, and tracklaying begins soon. H. T. Reynolds, of Springfield, Utah, has the contract.

St. Joe, Excelsior & Southern.—This road is being built between St. Joe and Excelsior, Mo., and when completed between these points is to be extended south. W. B. Johnson and James E. McColgin, both of St. Joe, are President and Secretary respectively.

Seattle, Lake Shore & Eastern.—Heavy rains which have swollen the creeks and rivers to a considerable extent, have been experienced during the past month in northwestern Washington and this has delayed the construction work on the northern branch of this road from Snohomish north to the International boundary line. The difficulty in securing laborers has also hindered the progress. Track is now laid to the Stillaguamish River, but has not yet been turned over to the company. It will, however, be ready for operation within two weeks. The contractors of the Stillaguamish bridge have nearly finished that structure. Track laying has begun in Sedro and will be extended both north and south. About four miles of grading has been finished north of the town ready for the track. A large force of graders are now working on a ten-mile section north of this, and will have it completed in about one month. Twenty miles of road is now graded south of the boundary line, which leaves a section of but ten miles from this place south to the point now being graded north of Sedro. On account of the high water in the Fraser River, but little work has been done of late on the bridge, but the contractors state that the entire structure will be finished and rails laid across it before the track is completed north to the boundary line.

South Bound.—The time for receiving bids by the Savannah Construction Co. for the construction of the first 38 miles of this road has been extended to July 1.

The stockholders of the Savannah Construction Co. have voted to increase its capital stock by $180,000 to $700,000. The increase has all been subscribed, $100,000 in Baltimore, $50,000 in South Carolina and $21,000 in Savannah.

Spokane Falls & Northern.—The grading on the extension from Marcus north to Little Dalles, Wash., 27 miles, is proceeding rapidly and all the line is under contract. Several miles have been graded, but tracklaying will probably not be begun until all the grading has been finished.

Tacoma, Olympia & Chehalis Valley.—This road has been built from Centralia, Wash., on the Northern Pacific, west a distance of 12 miles to Black River Junction, and also from Centralia east to coal mines three and one-half miles. The latter line is under contract for nine miles further eastward, and is being graded for that distance. The division completed to Black River Junction is being extended by the Northern Pacific to the coast, at Ocosto on the south side of Grays Harbor, a distance of 49 miles. It is also to be built to South Bend, on Shoalwater Bay, a distance of 41 miles. Griggs & Heustis, of Tacoma, are the contractors. Their headquaters at present are at Centralia. South Bend is on the route of the Portland & Puget Sound road. The Oregon & Washington Territory has about 300 teams and 350 men at work on the grading of a line from Centralia to Grays Harbor City, on the north side of Grays Harbor, a distance of 59 miles. About six miles of grading has been completed.

Talladega & Coosa.—Work has been commenced on a branch from Renfroe, Ala., to the Cook ore mines, in order to supply the Talladega furnaces with ore. The line is about 12 miles long. It is expected that the branch will be completed in a very short time, and that trains will be running over it by Aug. 1.

Toledo & Detroit.—Articles of incorporation have been filed in Ohio by this company, whose directors are the same as those of the Toledo & Western which is projected from Toledo, west to some point in Indiana near Chicago.

Troy & New England.—It is stated that the directors have received a proposition from a company which agrees to build the line between Troy, N. Y., and the Connecticut state line if $150,000 of the capital stock of the road is subscribed in Troy.

Union Pacific.—Work on the standard gauging of the Utah Northern division, is being pushed vigorously. The track is being laid at the rate of two miles a day, the work being prosecuted from McKammon south and from Ogden north, and the grading is progressing from several points. The main line will be finished and trains running by September 1, next, and the Cache Valley loop is to be ready 30 days later. The force of men is being increased. The total cost of the improvement is put at $2,000,000.

The transfer to this company of the narrow gauge San Pete Valley road will be effected very shortly, and work will then probably be soon commenced on an extension south through San Pete and Sevier counties.

Work is progressing on the branch from near Trinidad, Col., southwesterly about 45 miles to the Maxwell grant in New Mexico.

Utah Central.—About 30 teams are grading west of the Jordan River, and the work has been about completed to Black Rock, Utah. It is stated that arrangements have been made for securing funds to complete all the proposed branches and extensions of the system.

Wadley & Mt. Vernon.—This road is now in operation, running double daily trains from Wadley to Blackville, Ala., the present terminus, a distance of 30 miles. The road will be extended in the near future, probably south to Mt. Vernon, and arrangements are now being made to begin work on the extension.

Waycross Air Line.—It is stated that work will soon begin on the division between Waycross, Ga., and St. Marys, Ga., on the Atlantic coast, a distance of about 60 miles. Grading is now in progress on the division from Waycross northwest to Cordele, a distance of about 78 miles. On this section about 20 miles have been graded and the tracklaying has been finished on 24 miles.

Western Maryland.—The engineers of the company are surveying the route of the proposed Tidewater extension from Arlington Station, where the new road begins, to Jones' Falls. The engineers have finished the work of locating the road from Arlington to Woodberry, and the difficulty over the acquisition of property which the road will require in that village has been practically settled. The money needed to build the tidewater and other proposed extensions will probably be raised by the issue of $4,000,000 bonds bearing five per cent. interest. These bonds will represent a first mortgage on all roads on which the money is expended, and on all acquisitions that may be secured to the road in its expenditure. The bonds will not represent a lien on the property of the road as at present existing. They will not be all floated at once, but will be issued from time to time as the necessities and progress of the work require.

GENERAL RAILROAD NEWS.

Baltimore & Ohio.—On July 1 the company will take full charge of the Columbus & Cincinnati Midland road, which is 71 miles long, and extends from Columbus, O., to Midland City. It has been controlled by the Baltimore & Ohio since 1884.

Charleston, Cincinnati & Chicago.—The court has decided every point in the case of the Massachusetts & Southern Construction Co. against certain townships in South Carolina in favor of the company. For the last two years there have been about $300,000 of township bonds of York and Lancaster counties, South Carolina, due to the Massachusetts & Southern Construction Co. on a contract made with the County Commissioners. These bonds were voted by the people, and executed and put in trust by the County Commissioners with the Boston Safe Deposit & Trust Co. The Commissioners have refused to deliver them according to their contract. Suit was brought by the company in the United States District Court, and the case was argued before Judge Bond, at Charleston, S. C., on May 19 last, resultiug in the decision as above.

Chautauqua Lake.—The company has resumed the running of trains between Jamestown and Mayfield, N. Y., 23 miles, after a short suspension. Liens were issued on what little rolling stock the company had, but it is not clear what arrangement was arrived at, to permit the company to resume the operation of its road. One account says that the equipment which will be used hereafter will be some of the rolling stock of the Western, New York & Pennsylvania. But the action of that company in refusing to allow the Chautauqua Lake line to continue the use of its tracks has greatly augmented the difficulties of the line and was probably the indirect, if not the principal cause of the embarrassment.

Illinois Central.—A Chicago newspaper publishes the following account in relation to the proposal to use the so-called "lake front" site for the location of the World's Fair. The Secretary of War will be asked to remove the Government Dock Line, which is at present established 1,760 ft. from the shore line, to a distance of about 700 ft. further eastward. This would make it extend southward from the eastern extremity of the Illinois Central docks on the south side of the river near its mouth to Twenty-second street. The plan is to fill in all of the basin west of this line between Randolph and Twenty-second streets. The Illinois Central will be asked to yield its present riparian rights and remove its tracks to the outer portion of the made land, which would make their course run from Twenty-second street northward along the edge of the new tract to Randolph street and east on that street to Michigan avenue. It is also proposed to give the railroad company 300 ft. right of way instead of the 200 ft. which it now has. The railroad on its part will be asked to fill in a portion of the new area, and the space between Fourteenth and Twenty-second streets has been indicated as its share of the work. There are other and further details, but all are so subject to modifications that they cannot be accurately foretold. For fair purposes exclusively, their plan contemplates the recovery of about 400 acres of land.

The net earnings from traffic for the eleven months ending May 31, 1890 and 1889 (May, 1890, estimated), were as follows:

	1890.	1889.	Increase.
Average miles operated....	2,275	2,099	176
Gross earnings.....	$13,449,926	$11,747,956	$1,701,970
Oper. expen. and taxes....	8,772,058	7,329,234	1,442,824
Per. imps. paid from income	265,469	250,321	15,148
Total.....	9,037,527	$7,579,555	$1,457,972
Net earnings.....	4,412,399	4,168,401	243,998

The Dubuque & Sioux City reports its gross and net earnings for the eleven months as follows:

	D. & S. C.		C. F. & M.	
	1890.	1889.	1890.	1889.
Miles	524	524	76	76
Gross earning	$1,771.949	$1,617,452	$87,420	$88,523
Oper. exps. & taxes	1,348.365	1,270,469	136,916	122,4?2
Net earnings	423,584	346,983	def. 49,496	def. 13,909

	Both roads.		
	1890.	1889	Increase.
Miles	600	600	
Gross earnings	$1,859,369	$1,705,975	$153,394
Oper. expen. and taxes	1.485,281	1,372,901	112,380
Net earnings	374.088	333,074	41,014

The Dubuque & Sioux City has also expended on permanent improvements $127,520, which has been charged to capital account. The amount so spent and charged for the corresponding period in 1888 and 1889 was $112,051.

Kansas City, Wyandotte & Northwestern.—The company has gained entrance into Kansas City and acquired the Union Depot facilities, having concluded a traffic arrangement with the Missouri Pacific by which it will use the tracks of that road into the Union Depot. In consequence of this the Northwestern has restored its passenger rates from two cents to three cents per mile, the cut having been made on account of its exclusion from the Union Depot.

Lake Shore & Michigan Southern.—The half-yearly statement presented to the meeting, the present month being partly estimated, makes the following showing: Gross earnings, $9,908,767; operating expenses and taxes, $6,919,280; net earnings, $2,989,487; increase in net earning, $104,512. The semi-annual two per cent. dividend amounts to $989,340, leaving a surplus for the half year of $320,157.

Lehigh Valley.—The company this week filed for record in New York a mortgage for $15,000,000 on the entire property of the Geneva & Sayre, the Auburn & Ithaca, and the Geneva & Van Ettenville roads. The mortgage is in favor of the Girard Life Insurance, Annuity & Trust Co., of Philadelphia. The money raised will be used in improving the Lehigh Valley system, and making provision for completing the roads in process of construction.

A formal consolidation of the Buffalo & Geneva, the Lehigh Valley and the Geneva & Van Ettenville with the Lehigh Valley has been affected, Mr. Elisha P. Wilbur being President of the consolidated system. The three roads named are branches in New York State of the Lehigh Valley system.

Louisville & Nashville.—The company proposes a new issue of bonds. The authorized issue is to be $75,000,000, and will be known as the Consolidated four per cents. Of these $3,000,000 have already been sold to a syndicate, $41,000,000 will be reserved to retire maturing bonds, and the balance will be used for terminals, improvements and betterments.

Louisville Southern.—The sale of this road to the East Tennessee, Virginia & Georgia has been practically completed, but the company will not assume control of the line for some time. It will probably be operated in connection with the Cincinnati Southern, with which it connects at Burgin, giving the latter road a line to Louisville.

Michigan Central.—The gross earnings for the first half of this year were $6,843,000; operating expenses and taxes, $4,968,000; net earnings, $1,875,000; interest and rentals, $1,222,000; surplus, $653,000. Of the surplus $181,000 goes to the Canada Southern road, as its share of the net earnings leaving $472,000, out of which $374,764 in dividends is to be paid. In these figures the earnings for June are estimated.

New York, Lake Erie & Western.—A rehearing was had before the New York State Railroad Commission this week in the matter of the complaint of the citizens of Painted Post against this company, asking for the removal of its embankment crossing the Chemung River at Painted Post, N. Y., so as to obviate the backing up of the water of the river in times of flood. The board some time ago decided that the railroad company should have its embankment kept open for a considerable distance, and this hearing is on the application of the company asking that the former decision of the board be reconsidered.

New York & New England.—Tha company has recently purchased about two miles of the Boston & Albany's Athol branch track in Springfield, Mass., over which it enters Springfield. It has heretofore used this track under a lease, and now purchases it in exchange for a piece of land which it owned, and which was needed by the Boston & Albany.

Pennsylvania.—The statement of the business of all lines east of Pittsburgh and Erie for May, 1890, as compared with the same month in 1889, shows an increase in gross earnings of $408,223, an increase in expenses of $420,934, and a decrease in net earnings of $12,711. The five months of 1890, as compared with the same period of 1889, show an increase in gross earnings of $2,713,290, an increase in expenses of $2,437,718, and an increase in net earnings of $275,572. All lines west of Pittsburgh and Erie, for the five months of 1890, show a surplus over all liabilities of $64,508, being a gain, as compared with the same period of 1889, of $346,861.

Philadelphia & Reading.—The statement of the operation of the road for the month of May, 1890, compared with the same month of 1889, is as follows: Gross receipts, May, 1890, $1,728,335; May, 1889, $1,617,673; increase, $110,662. Gross expenses, excluding rental and interest, May, 1890, $1,037,210; May, 1889, $957,732; increase, $79,477. Profit in operating, May, 1890, $691,125; May, 1889, $659,940; increase, $31,184.

St. Louis & Suburban.—The St. Louis Cable & Western, composed of a cable road running from Sixth and Locust streets, St. Louis, to Vandeventer avenue, in the western suburbs, and a narrow gauge steam road about 15 miles long, was sold at public auction June 21 under decree of court, and was bought by Lee, Higginson & Co., of Boston, who represented the second mortgage bondholders. The price paid was $150,000. The original stock of $1,000,000 is wiped out by the sale, and a floating indebtedness of $283,000 will be paid pro rata to judgment holders out of the purchase money. The road has $1,000,000 bonds. The company will be recognized under the name of the St. Louis & Suburban. Charles H. Turner, of St. Louis, will be President.

Scioto Valley & New England.—The Norfolk & Western has secured control of this road, having exchanged $3,000,000 of its preferred stock for $5,000,000 of the common stock of the road acquired. The market value of Norfolk & Western preferred stock i $63 per share of the par value of $100, an the market value of the 30,000 shares exchanged $1,890,000. The road purchased has $5,000,000 of four per cent. bonds outstanding, and the Norfolk & Western assumes the payment of $200,000 annual charges on these bonds. The road is in good condition, and it has low grades and light curvature. It owns very valuable terminal facilities in Ironton, O., including tracks into all the manufacturing establishments, and it crosses and connects with the Pennsylvania, Baltimore & Ohio, Cincinnati, Hamilton & Dayton, and Ohio & Northwestern and other roads. Its acquisition, therefore, saves the Norfolk & Western a considerable expenditure for construction and terminals at Ironton, and gives it important connections in Ohio through the extension now being built through West Virginia to Ironton. The Scioto Valley & New England extends from Ironton to Columbus, O., a distance of about 132 miles.

TRAFFIC.

Chicago Traffic Matters.

CHICAGO, June 25, 1890.

While both passenger and freight matters in the Western Association territory are mending, the situation in Central Traffic and Trunk Line territory is daily growing decidedly worse, and unless some amicable arrangement is arrived at soon the fight, which has been made so far mainly on dressed beef and cattle, will extend to many other commodities, and the demoralization become general. June 20 the Grand Trunk promptly anticipated the 36 cent rate on dressed beef, announced by the Lake Shore, effective to-morrow, by announcing a 33 cent rate, effective June 23, thus increasing the difference to 6 cents from June 23 to 26. It is understood that the Grand Trunk will announce a 30 cent rate from Chicago to Boston in a day or two, which will doubtless be met by the competitors.

Chairman Goddard, of the new Western Passenger Association, has called for all contracts made by the lines in the association prior to its formation. He says he knows of nothing but the $18 Denver contract which will interfere with the successful working of the Association. The Trans-Missouri Passenger Association has formally voted to disband.

The Passenger Department of the Central Traffic Association hold their regular quarterly rate meeting July 7. The principal work before the committee will be the making up of the quarterly issue of joint rate sheets to take effect Aug. 1. No chairman for the Passenger Department has yet been found. General Passenger Agent Donald, of the Chicago & Atlantic, is the latest possible candidate mentioned.

The Central Traffic and Trunk Line associations have made a round-trip rate of one first-class fare to Boston on account of the reunion of the G. A. R. in August. It is reported that the roads in the associations which receive a differential on the regular business will claim the same on this excursion rate. If they do, there is likely to be a good-sized row.

The Western roads have received notice from the Interstate Commerce Commission that they will be given a hearing at Washington, July 8, in the matter of rates on food products, in order to show cause, if they can, why an order should not be issued by the Commission in accordance with the findings in the case as given by Commissioner Morrison. The officials of the lines were astounded when they received the news of the findings of the Commission, and could scarcely credit the information that such an order was seriously contemplated. After having voluntarily made the considerable reductions in the corn rate asked for last winter as an "emergency rate," at a sacrifice of several millions of dollars of revenue, they had assurances from both producers and shippers that the rates were entirely satisfactory, and that a large part of the hue and cry was being made for political buncombe. Chairman Walker will appear at this hearing as the principal counsel for the railroads, assisted by officers of the legal departments of the more prominent roads interested. Mr. Walker will base his arguments on the grounds outlined in the note printed in these columns last week.

The "Monon" will on July 1 call in all the annual passes issued by the old management, alleging that some of them have been found in the hands of parties for whom they were neither issued nor intended, and also because the official record is defective.

The Michigan Central case before Judge Blodgett, of the United States Circuit Court, was resumed on Thursday. One of the defendants, Watson P. Griswold, had the case against him *nolle prossed* on account of a defect in the indictment, where he is named as "Matson." The defendants pleaded "not guilty," and both sides waived a jury. The District Attorney, in his opening argument, reviewed the transactions at length, stating that, while the fixed schedule between Chicago and New York at the time was 20 cents per 100 lbs., he expected to prove that Charles B. Slade and F. S. Martin, agents of Counselman & Co., made an arrangement with the agents of the road whereby they obtained a rate of 18$\frac{2}{10}$ cents by manufacturing ficticious way bills, alleging that the shipments came from the "110 per cent. district," so known, thereby manipulating the rate as above. Slade, being put on the stand, admitted this arrangement between Martin, Griswold and Street, and explained how the bills were made out in Counselman's office, and were stamped with a certain red stamp to pay only to the Santa Fe Elevator Co. F. S. Martin corroborated Slade, and some of the waybills were identified by a clerk in the M. C. local Freight Agent's office. B. P. Price, State Grain Inspector, testified as to the number of cars shipped. On Friday, E. T. Tibbetts, a clerk in the Michigan Central freight department, testified to noticing the red stamp, and, on inquiring about it, was told by Street that it was all right. Mr. Mackay has been discharged, the court deciding that he had no guilty knowledge of the transactions. The hearing has been closed and the cases of Messrs. Nicholas and Somers have been taken under advisement by the court.

Traffic Notes.

The through train from Boston via the Poughkeepsie Bridge now runs through solid to Harrisburg, as at first announced.

It is estimated that 12,000 carloads of watermelons will be shipped from southwestern Georgia this season. Shipping has just begun. It said 35 soliciting agents are now in that territory bidding for the business.

The Central Traffic Association recently authorized a rate of $4 a ton on ice from Chicago to New York, as applied for by the Michigan Central Railroad. This is probably the first shipment of Wisconsin ice to New York on record.

The Illinois Central has completed arrangements with the Government for putting on the new fast mail train between Chicago and New Orleans on July 1. The time between the two cities will be thirty hours. It will leave Chicago at 3 o'clock in the morning.

The Houston & Texas Central, in connection with the St. Louis, Arkansas & Texas, has put in a rate of 25 cents per 100 lbs. on cattle from Texas points to St. Louis, a reduction of 11 cents per cwt. This reduction is made as an act of retaliation on the Missouri, Kansas & Texas for its cut in the corn rate to Texas.

It is announced that a through train is to be put on June 30, between Boston and Washington, to run over the Boston & Maine, New York, New Haven & Hartford, Central New England & Western, Pennsylvania, Poughkeepsie & Boston, Central of New Jersey, Philadelphia & Reading and Baltimore & Ohio.

An outside ticket office lately established in the first ward of New York City has caused considerable discussion among the trunk lines, some of the roads claiming that others secretly support the new office contrary to the agreement between the roads. It is said that commission paying, to offset the irregularity, has already begun.

Important reductions in coal freights are being made by the New York, New Haven & Hartford road. The rate from New York to Waterbury is now $1.20 per ton instead of $1.45. The New York & New England does the same on coal hauled from the mines, and the two roads thus meet the $1.20 rate which the Meriden, Waterbury & Connecticut River road has been charging for coal which it took to Waterbury by way of the Connecticut River. A reduction is also to be made in the rates from New Haven to Springfield from 90 to 75 cents per ton, taking in all intermediate points. This will compel the New York & New England to reduce its rate to New Britain to correspond. A reduction will also be made on the Northampton division. These reductions had their origin, it is said, in reductions made by the Boston & Albany in competition with the New York & New England's all-rail coal business.

Train Service on Unprofitable Lines in Kansas.

The Kansas Railroad Commissioners have announced their opinion in the matter of the petition of the Mayor and Council of Oskaloosa for the restoration of the passenger train service on the Leavenworth, Topeka & Southwestern. The board recognizes the fact that the traffic on the line is so light that it will not pay operating expenses, yet the people along the line subscribed liberally toward the construction of the road under promise that they should have good service, and the board holds that that promise should be kept. It is therefore ordered that the passenger-train service petitioned for be put on within 30 days.

Iowa Freight Rates.

The Iowa Railroad Commission has promulgated its joint rate tariff to go into effect July 4. The maximum rate to be charged by any railroad receiving business from a shipper at a station on its line within the state, destined to a point within the state on another line, shall be it mileage proportion of the rate for the entire distance for through shipment based on its own Iowa rate according to its class, with the following percentages added: Five to 100 miles, 15 per cent.; 105 to 200 miles, 11 per cent.; 210 to 300 miles, 9 per cent.; 310 to 400 miles and over, 7 per cent. The maximum rate of freight to be charged by any railroad receiving business originating on the line of another railroad at a point within the state and destined to a point within the state on its line, shall be its mileage proportion of the rate for the entire distance for through shipment based on its own Iowa rate according to its class, with the following percentage added: 5 to 100 miles, 12 per cent.; 105 to 200 miles, 9 per cent.; 210 to 300 miles, 7 per cent.; 310 to 400 miles and over, 5 per cent. This rule will not apply to business received from or delivered to the Burlington, Cedar Rapids & Northern, pending the hearing of the injunction proceedings instituted by that company restraining the Commissioners from making rates.

Universal Classification.

The meeting of the universal classification committee at Buffalo this week completed the committee's work for submission to the traffic associations interested. The work was checked two months ago by the decision of the Interstate Commerce Commissioners declaring the difference in rates between car load and less than car load lots excessive. It has required about that length of time for the committee to decide just what to do under the circumstances. It concluded to finish the work as originally planned regardless of the decision and then to submit it to the commission and to the traffic organizations for approval.

Supply Shops Burned.

The shops of the Birmingham Railway Supply Co., at Birmingham, Ala., were burned last week. The loss will amount to $60,000, with no insurance. The blacksmith and machine shops, wooden buildings, were destroyed, but the foundry and paint shops were saved. Two engines and two passenger and an iron freight car were destroyed or seriously damaged. A large planer in the machine shop is a total loss; also two nut tappers, three drill presses, three lathes, etc. Thirty new machines in the wood-working department are either a total loss or can be repaired only at a great cost.

East-bound Shipments.

The shipments of east-bound freight from Chicago by all the lines for the week ending Saturday, June 21, amounted to 51,006 tons, against 57,308 tons during the preceding week, a decrease of 6,302 tons, and against 39,365 tons during the corresponding week of 1889, an increase of 11,641 tons. The proportions carried by each road were:

	W'k to June 21.		W'k to June 14.	
	Tons.	P. c.	Tons.	P. c.
Michigan Central	8,323	16.3	6,729	11.7
Wabash	3,417	6.7	3,154	5.5
Lake Shore & Michigan South.	8,164	16.0	10,397	18.1
Pitts., Ft. Wayne & Chicago	6,076	11.9	7,506	13.1
Chicago, St. Louis & Pitts.	5,795	11.4	7,145	12.5
Baltimore & Ohio	2,860	5 6	3,315	5 8
Chicago & Grand Trunk	6.623	13 0	7,441	13 0
New York, Chic. & St. Louis	3,806	7.5	5,437	9.5
Chicago & Atlantic	5,941	11.6	6,184	10.8
Total	51.006	100.0	57,308	100 0

Of the above shipments 1,172 tons were flour, 18,533 tons grain, 1,335 tons millstuffs, 6,231 tons cured meats, 1,796 tons lard, 9,601 tons dressed beef, 2,361 tons butter, 1,195 tons hides, 246 tons wool and 6,737 tons lumber. The three Vanderbilt lines carried 39.8 per cent., while the two Pennsylvania lines carried 23.3 per cent.